EDUCATIONAL TECHNOLOGY

Challenging Issues

Edited by

M. Mukhopadhyay

Educational technology has today become a major issue in the field of education and training. Until recently interest in educational technology was limited to academic studies of the subject in the preparation of teachers at the secondary level. Later-day developments in communication technology, particularly the media and computers, have created an awareness of the need for wider application of educational technology at various levels of education as well as training in industry, business, banking, etc. This has raised new planning and managerial issues vis-a-vis its effective utilisation.

This book is a major effort in bringing together a detailed critical analysis of educational technology as perceived and applied at different levels of education, namely, school and collegiate education, adult and special education, management and medical education, agricultural and teacher education, army education, etc. Each chapter is contributed by a specialist in the concerned field.

The volume should be of particular interest to educational planners and administrators, teaching faculties in all branches of education, trainers and training managers in banking, industry and such other sectors, research workers and scholars in the fields of educational and training technologies.

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M. MUKHOPADHYAY

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PREFACE

Educational Technology in India was the brainchild of a few handpicked individual scholars in the mid-sixties. At that stage and much later, too, educational technology was primarily programmed learning. They did well to form a professional society, now known as All India Association for Educational Technology. The AIAET, then known as IAPL (later on as IAPL & EI and IAET) played a quiet but significant role in diffusing educational technology in the programmes of teacher preparation all over the country. But it was still pedagogy, theoretical and a softer approach to educational technology.

The national and state administrations woke up relatively later. Even then they did not want to be a party to pedagogy. Whatever be the reason—naivety, ignorance or conviction—the state participation brought a massive thrust on audio-visual aids. Later on, more sophistication came with advanced technologies in the form of electronic mass media like TV, radio, projectors, VCR/VCP, computers etc.

With pedagogues and behavioural scientists contributing the main framework-technology of education and state supplementing technology in education, educational technology is taking a new professional shape in India. Working committees on educational technology in the Five-Year Plans, separate expert groups on educational technology in National Policy on Education 1986 and Programme of Action,etc., are some of the indications of its recognition as a major instrument of change in education. It is no more kept aside as "something to do with schools and the B.Ed."

Educational technology can play a role at every level of education and human resource development activity. But choice of technology, the blueprint for implementation, materials, etc., may not be the same. Each sector of education has its own unique features and hence there are many issues with regard to educational technology which need to be critically examined, discussed and highlighted.

We have, in this country, a few books on educational technology. These are essentially given to introduce educational technology to the beginners—often the teacher-trainees as the targets. The present volume looks at the other side of the coin. It deals with practices, provisions, and critical issues of educational technology at various levels of education. It also contains a chapter on training technology in the Indian Navy. Chapters have been contributed by reputed scholars in their own fields and sectors of education.

Let me add a word about the spirit in which the book has been developed. All chapters are voluntary contributions by the authors. Whatever royalty this book generates would go to the All India Association for Educational Technology and not to any individual. This would facilitate, I hope, accomplishment of the goals of the AIAET to some extent. The authors are members, friends and well-wishers of AIAET and educational technology. Their contributions are gratefully acknowledged.

Personally, I feel honoured to have the editorial responsibility. I am indebted to each and every author for his/her contribution.

Sri. Panicker worked meticulously on typing the manuscript again and again. Sri. S.K. Ghai readily agreed to publish this volume. I thank Sri Panicker and Sri S.K. Ghai of Sterling Publishers.

M.Mukhopadhyay

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1

EDUCATIONAL TECHNOLOGY AND NATIONAL POLICY ON EDUCATION

M. Mukhopadhyay

Educational technology has been given a specific place in the National Policy on Education 1986 by the provision of a separate section titled, "Media and Educational Technology". The indications of educational technology finding a place in the NPE were apparent with the appointment of a Working Committee on Educational Technology for the last two consecutive Plans. This was a new development, a new recognition of educational technology as an activity of significance. Subsequent to NPE, a Committee was appointed to go into the details of implementation of the recommendations regarding educational technology in the policy document. The Programme of Action deals in detail with the present scenario, strategies and plan of action. In the Programme of Action, the chapter dealing with this issue was titled, "Educational Technology Including Computers". At a still later stage, a document titled, "Educational Technology Programme" was prepared by the Department of Education, Ministry of Human Resource Development. The implementation report on NPE carries two separate entries—one on Educational Technology and the other on Computers, the former exclusively on media.

From different nomenclatures, shifting of emphasis in the four documents referred to above, there seems to be some vascillation in conceptualising technology.

In this context and also in the recognition of educational technology, it will be worthwhile examining educational technology from a professional standpoint, how it is referred to in the National Policy and what some of the major emerging issues are.

Educational Technology : A Professional Look

Technology induction in different professions/vocations has certain patterns. The farmer switched over from spades and ploughs to tractors, a printer from hand-composed traddle machines to present-day automatic DTPs and offset printers, a practising doctor from dependence upon the pulse beat to a wide range of pathological sciences with advanced equipments. Such shifts indicate that technology induction is primarily to achieve increased productivity and improved quality. Also, the embodied technology referred to above is strongly supported by disembodied technology in the form of research on soil and seeds, or computer software, or the advancing medical sciences, bio-chemistry, etc. Most of these inductions were with the purpose of problem solving.

Education faces similar problems—low enrolment and high dropout, poor performance, low level of cognition, lack of problem-solving skills etc. Educational technology also emerged in the educational scenario to solve some of the problems.

From the perspective of professional approach to problem-solving, educational technology has been conceptualised and defined. We quote two internationally accepted definitions below. Most comprehensive and acceptable approach to conceptualising educational technology is to consider it from its two interactive components, namely, technology of education and technology in education.

Technology of education is the disembodied component which provides a much needed psychological and systemic basis for educational technology. This could be considered with reference to a few dimensions given below:

(a) Like other technological and social problems, educational problems are multi-variate by nature. Any piecemeal approach to solve such problems without taking into consideration the presage, process and product variables are inadequate to explain the educational situation and for solving its problems. Hence, the first important component of educational technology is a systemic view of education and the problems. In other words, systems approach is the first contribution of educational technology to solve educational problems.

(b) Psychological research over the last several decades has contributed significantly to the understanding of the process of human learning. Instructional strategies corresponding to the psychology of human learning is another major consideration of educational technology. Such correspondence led to the development of programmed instruction as well as programmed teaching as instructional approaches and alternatives. This is another component of technology of education.

(c) The psychological research on human learning—both children and adult—also shed light on learning at different levels of cognition: knowledge, comprehension, application, analysis, synthesis, evaluation, etc. It was also indicated that any single approach to instruction is totally inadequate for contributing to different levels of cognition. It was found that a series of learning activities organised in certain combinations and sequences leads to achievement of higher cognition. These approaches may include reading of texts/programmed texts, group interaction, role-play simulation, reference reading etc. Thus multi-media approach to instruction came to be a major concern and contribution of educational technology.

(d) The multi-sensory approach to learning, particularly through audio and visual media as an outcome of communication technology was another component of educational technology. This is also related to the concept of multi-media approach. The multi-sensory approach is also found to be able to retain human interest over a longer period of time, and thus facilitate learning.

(e) Finally, educational technology acknowledges the individual difference—another contribution of psychological research. The entire domain of individualisation of instruction through programmed learning, personalised instruction, self-learning modules, multi-media learning packages, etc., is another important dimension of technology of education.

The proper use and implementation of technology of education require the support of aids and inputs based on hardware or technology in education.

Technology in education implies hardware and hardware related software. Such hardware/software include projectors, audio equipment, close-circuit television, VCR, TV monitors, radio, programmable calculators, computers, laboratory and workshop equipment, etc.

It would be obvious from the perspectives of educational technology as an interactive function of technology of education and technology in education, that its main frame reference remains technology of education that provides the broader design support to instructional strategies. It is necessary to emphasise that in the process, technology in education provides support to the technology of education and its designs.

From this point of view, the teacher has a central role to play in solving educational problems through educational technology. He/she has the responsibility of designing the learning system and making the choice of technology—whether video or television, computer, etc. These equipments by themselves are of limited significance and cannot replace a teacher. In fact, a teacher's role becomes far more challenging, and complicated, and adds the much needed managerial dimension. Given this professional perspective of educational technology, it would be worthwhile reconsidering educational technology in the National Policy on Education.

Educational Technology in NPE 1986

As mentioned earlier, educational technology finds a separate place in the NPE as well as in the Programme of Action. These chapters, however, do not represent the professional view of educational technology. In fact, they are restricted to media technology and in the case of the Programme of Action, to media and computers. It is interesting to note that in this major policy document, educational technology is equated to media technology which forms only a part of educational technology. Thereby, educational technology in NPE, POA is one-dimensional.

On the contrary, there are several statements spread over different chapters in the NPE 1986 and Programme of Action which imply that educational technology is the disembodied component of educational technology. For example, in the contents and processes of education, there are several statements which indicate accommodation of psychological principles of learning thereby accommodating many dimensions of technology of education.

A recent analysis of recommendations (Juneja, 1987) in different chapters of NPE and POA indicates that educational technology percolates throughout the document of National Policy on Education. Such statements also indicate certain choices of technology. For example, in the section on Higher Education, the Programme of Action mentions preparation of video lectures on 15 subjects for collegiate education—indicating the option for VAI.

Considering this pervasiveness of educational technology in all chapters, it could possibly be said that the gross inadequacy of conceptualisation of educational technology in the concerned section of the National Policy is reasonably compensated.

In the post policy stage, there is an important dilemma vis-a-vis educational technology. This is between implementation of educational technology related policies and the role of educational technology and use of educational technology in implementation of National Policy on Education. Apart from the point of view of educational policy , it has to be seen as an instrument of educational change. In that context, emphasis has to be on implementation of the National Policy on Education thereby examining the role of educational technology. It would be worthwhile at this stage to examine some of the major national concerns of education, as indicated in the challenge of education, NPE, POA and the first Report of Implementation, March, 1988.

Some Major Issues

The first major concern of the NPE is education for all—UEE and adult education being of prime concern. Operation Blackboard as a scheme provides for radio-cum-cassette players to all the primary schools by 1990. Implementation is under way with respect to 20 per cent of the CD blocks except in two states. This also creates the provision of 1,00,000 TV sets and 5,00,000 radio-cum-cassette players in primary and upper primary schools.

The All India Radio has been broadcasting programmes on education for a very long time. With the national network on radio with 70 FM transmitter, the radio broadcast is also likely to undergo change. The increasing broadcast time interfaced with provision of reception sets is a major development. The Policy Document as well as subsequent documents have been championing the cause of dedicated channel for education.

Although not as a part of the National Policy, the Government of Andhra Pradesh took a major step ahead and introduced video aided education at the primary level on an experimental basis.

The above instances will bring home the point of increasing availability of reception sets at the institutional level and transmission time available on radio and television. Nevertheless, the documents including the implementation report seems to be oblivious of gross under-utilisation of such sets. Many of the studies (Seth, 1983 SCERT 1982, Mohanty and Giri 1976, Sord 1982, Nagaraju and Ramkumar 1983, Pillay 1987) on media indicate the utilisation rate to be as low as 10 to 20 per cent. This is only a quantitative figure. Qualitative analysis is far more frightening. Very often such use amounted to putting on the sets and the teacher taking time off. This has a restricted educational value as would be evident from another set of research on teacher intervention in media presentation.

The preparation of teachers—their skills, attitudes and behaviours—has not figured in any of the documents. Given the experiences and the previous studies, it would not be difficult to infer that much of the investment on the media sets will remain grossly under-utilised unless some specific strategy decisions are taken to improve the manpower in the educational institutions vis-a-vis use of educational technology.

In higher education, television sets have been provided to 2,000 colleges and UGC has allowed the rest of the colleges to procure television sets from its development grants. UGC telecast programmes for nearly two hours everyday. In a recent development, the Indira Gandhi National Open University is also being provided broadcasting time on television network. Once again, the investment on the transmission time and on reception sets does not seem to corroborate with preparation at the grassroots level for receiving the programme. The under-utilisation rate of telecast in higher education is no better than the school education sector as revealed by a number of studies so far conducted in India (Pillai, 1987).

Further, the software in higher education is still not tuned to the academic and educational needs of students. Many of the programmes are imported. These are qualitatively good but not necessarily related to the course and curriculum. Indian programmes are struggling to develop quality. Nevertheless, the question remains regarding the creation of an environment in the colleges including the attitudes of college teachers to make the best use of the educational broadcasts through television as well as radio. There does not seem to be any specific provision in the various schemes about preparation of teachers of higher education for utilisation of media. Even academic staff of colleges do not appear to take this issue seriously.

The computer has been introduced in schools and for higher education. In schools it has been introduced under the CLASS Project for computer literacy. The Implementation Report of National Policy on Education reveals that the evaluation of the CLASS Project indicated achievement of its primary objectives of de-mystification with only 15 per cent of the students exposed to computer literacy. Similarly, out of approximately 15 CAI software packages supplied to these schools, most schools used only the 'welcome' package. Both these evaluative comments indicate a gross under-performance of computer education at the school level. However, the Implementation Report went ahead with expansion of CLASS Project from 1,250 schools (now 2,000) to 13,000 higher secondary schools with five to eight terminals. Without adequate retuning of the management systems, expansion is a matter of major concern.

As a response to this concern, a committee was appointed to design management system for CLASS. This may help in designing a management structure. Unless managerial processes are retuned, the chances of its success are limited. A total recast on teacher preparation and technology literacy for teachers is very necessary.

In higher education, computers have been provided with a multiple set of objectives, namely, increasing efficiency, introduction of computer-related courses and computer literacy among college students. So far, UGC has provided computers to only 124 colleges. Its proposal is to provide computers to another 300 colleges. A disconcerting gap arises when all higher secondary students of the 13,000 schools are exposed to computers under the CLASS Project but only 400 of the 6,000 colleges provide continued exposure, i.e. to about 7 per cent students.

A scrutiny of the National Policy on Education reveals a total lack of concern by the policy-makers regarding the involvement and development of teacher educators. Almost invariably, they have been excluded. At a later stage, there have been some specific recommendations regarding improvement of teacher education by setting up of DIETs; similarly, upgrading of selected secondary teacher training colleges with extra resources, and setting up of Academic Staff Colleges for higher education. The major shift in the policy on teacher education has been primarily in changing the structure. Without any evidence that the reorganisation of primary teacher training in J&K in the form of DIE has led to any improvement of teacher training and the emergence of this system as a superior alternative to those practised in other states, DIETs are not likely to be a solution. Similarly teacher education at the secondary level will not significantly improve just by additional facilities. The important missing component is the improvement of skills, capabilities and attitudes of teacher educators in the teacher education institutions. The document on DIET and subsequent recommendations by many states indicate, almost without exception, that DIETs would be run by poorly paid professionals. The pay structure is designed to accommodate bureaucratic norms without any reference to academic requirements of the teacher training system. Hence, the stagnating teachers in higher secondary schools and such other professionals are likely to come over to DIETs. This is the case in Jammu and Kashmir too where DIEs are now largely the dumping ground for those who are not desired in other places. DIETs as well as secondary teacher training institutions would have a separate unit on educational technology. They will be expected to train teachers in the use of educational technology. A major concern is the lack of skills among such faculty and lack of opportunity for training to be a trainer in educational technology.

In higher education too, the course design in academic staff colleges is overburdened with socio-economic issues. There is marginal input on pedagogical processes including educational technology. Unless teacher educators and teachers are properly trained in educational technology, the chances of its success are very remote. In the final analysis, the teacher educators had to be drafted since the expected scholars in science and social science did not find it challenging nor could they subscribe to it. Despite poor standards pervading in almost all the disciplines—be it economics, political science or physics—avoiding pedagogical sciences is a form of educational apartheid.

In the interests of higher education, teacher development as a professional activity should be firmly absorbed in all teacher training programmes. There is inefficiency built into Government organisations. This inefficiency might percolate into low productivity in terms of number of programmes. But more often it might affect the quality of programmes. The video programmes on elementary education in Andhra Pradesh produced by professionals from the Telugu film world has a sharply different quality than the software produced elsewhere.

The consequent problem to fund allocation exclusively to governmental agencies is subsumption of funds into infrastructure development. Much of the funds would get absorbed in construction of buildings, creation of posts, procurement of equipment, etc. It would be quite a difficult proposition to optimise the use of funds allocated to the infrastructure aspects. By this process, the competitive aspect would be eliminated in the area of software production, and the future of educational software would be mortgaged to the efficiency of a few centres. Market mechanism is a potent tool in quality building in open economies and in many areas India has opted for it. Education seems to fight shy and operates with a monopolistic approach to software production.

Conclusion

In the overall analysis of educational technology in the National Policy on Education, there emerges a mixed feeling. The accommodation of educational technology as an area of consideration is satisfying to the extent that educational technology has derived its recognition among the planners and policy-makers. Nevertheless, it has also been equated with media technology without the corresponding emphasis on human development. This partial view of educational technology gets compensated by far more scientific reflections of educational technology in other chapters of the same document, the NPE 1986.

In the process of implementation of educational technology per se, it boils down to substantial fund input to CIET and SIET institutions for building infrastructure, and creating provision for reception sets to schools and colleges. Neither of these two provisions are adequately corroborated with the managerial process and human components, letting the benefit of this investment lapse. Governmental policy-making, once again, lays down the infrastructure and leaves the weaving of different components for optimising productivity wide open.

Educational technology is highly potent to contribute its might to the achievement of some of the major national goals in education. The success would depend upon the utilisation of educational technology. Human resource development in educational technology would remain the crux of the problem. Unless it is attended to immediately and very seriously, we might land up with highly wasteful investment which would be brought to light by an evaluation committee appointed several years from now.

Works Cited

Department of Education, *National Policy on Education, 1986,* New Delhi, GOI Press, 1986.

—*Programme of Action,* New Delhi : GOI Press 1986.

—*National Policy on Education 1986: Implementation Report,* New Delhi : GOI Press, 1988.

Elton, L.R.B., Educational Technology—Today and Tomorrow. In Hills P. and Gilbert, J. (eds) *Aspects of Educational Technology XI,* Kogan Page, London 1977.

Juneja, N. Programme of Action for Educational Technology—Who will bridge the gap? *Media and Technology for Human Resource Development,* April, 1987.

Mohanty, J & Giri, A.P., *A Study on School Broadcast Programmes,* Directorate of Higher Education, Orissa, 1976.

Nagaraju, C.S. and Ramkumar, U., *School Broadcasting Utilisation by High Schools in Bangalore District,* Bangalore ISEC, 1982.

Pillai, G.S., The Status of Indian Educational Television Programme, Paper presented in XX Annual Conference of AIAET, Udang, 1987.

SCERT, *An on-the-spot Evaluative Study on School Broadcast Programmes in Towns of Cuttack and Bhubaneswar,* Bhubaneswar, SCERT, 1982.

Seth, I., A Study of Effectiveness of Educational Television on the Educational Development of Primary School children, unpublished doctoral thesis, M.S. University, 1983.

Sood, K.S.L, *Evaluation Reports of Educational Broadcast in Haryana Schools.* First Series 1981-82, Gurgaon, SCERT, 1982.

2

ROLE OF EDUCATIONAL TECHNOLOGY IN STRATEGIC PLANNING FOR EDUCATION

S.S. Kulkarni

One of the questions that often torments an Indian educator is that after all the commissions on education since the beginning of this century and with the political support by stalwarts like Pandit Nehru, and moral support from the Presidents of India like Sir S. Radhakrishnan, why does the education system in India lag miles behind in achieving even commonly accepted goals of adult literacy or why cannot the rate of dropouts be reduced, etc.?

There seems to be a consensus regarding the policy goals in these and many other areas and yet, when it comes to achieving the physical targets (as distinguished from the financial targets—money spent), we seem to be trailing much behind what is expected to be achieved. Why?

The major contention of this paper is that this happens because most of us are not conscious about the distinction between agreeing on policy goals and strategic operation planning. This further results in our failure to implement consistently the planned strategy and required operations. The challenge of education released by the Ministry of Education (1985) points out, "... many of the changes required in education were anticipated by the earlier Committees and Commissions especially the Education Commission (1964-66). Perhaps the problems of today are more the result of tardy and haphazard implementation and a progressive decline in the allocation of resources. It is, therefore, envisaged that the New Education Policy should articulate the educational imperatives not only in terms of objectives, concepts and priorities but it should also spell out an operational strategy with the associated financial, material, organisational and human requirements to achieve the long and short term objective set forth in the policy. If a radical change in educational policy is agreed upon, equally radical instruments and organisational structures will have to be devised to give it a practical shape" (Ministry of Education, 1985).

An educational technologist has a role to play on all these three levels: 1) formulation of goals—policy planning; 2) formulating and selecting appropriate modes of attaining those goals—strategy planning; and 3) operational planning and implementation in the field—tactical planning.

The educational technologist can certainly help the policy framers clarify their goals—by transforming them in behavioural objectives—into what is generally called physical targets. The transformation of policy goals into behaviour objectives also makes it easier to choose from them, prioritise them and, still more important, make them understandable by the large masses—the large number of persons involved in implementing the strategies.

The next important step which, however, is not taken by the national level policy planners is to systematically design the alternative strategies, appropriate to the situations which differ from state to state or within the same state from region to region and also for different target groups within that region, e.g. pre-school children, dropouts from the school system, adults working on farms and those working in factories, etc.

An educational technologist is trained to formulate strategies appropriate to the goals and target groups.

It is, of course, nobody's claim that the educational technologist in India has all the solutions and alternative strategies ready in his bag only to be dished out as soon as the policy is announced. But, there is certainly an approach, a method of arriving at solutions, of designing strategies and tactics at various levels in this grand adventure called education. In this paper, an attempt will be made to illustrate the application of this approach to one of the critical sectors of education, viz., teacher education.

Teacher Education : An Overview

The document "Challenge of Education" referred to earlier, points out that "teacher performance is the most critical input in the field of education. Whatever policies may be laid down, in the ultimate analysis these have to be interpreted and implemented by teachers, as much through their personal example as through teaching-learning processes. We are on the threshold of the development of new technologies likely to revolutionise teaching in classrooms. But unfortunately, the process of updating the curricula of teacher education has been very slow. Much of the teacher education is irrelevant to contemporary requirements, leave alone those of the future". (This is a very strong indictment - but then unfortunately true.) What is the solution to get out of this situation?

The temptation for those who are in the system and particularly for those in authority (even those who occupy a headmaster's broken chair in a village school) is to think in terms of "Give me more power, give me more resources, let me have more of the same drink." Many teacher educators feel that the problem can be solved by instituting a B.Ed. course of five years instead of the present one year, a D.Ed course for primary teachers for three years (if not for five years). A group in Bombay has even designed a course for pre-primary teachers for four years. All this has been done in the hope of increasing teachers' competencies, commitments and all those well-aspired goals. Some of them would also like to raise the eligibility criteria for admission to teachers' colleges nearer to the IAS standard (if not higher), and of course, plead for salaries which are equivalent to (if not more than) the union government's administrative services.

Without prejudice against raising teachers' salaries one should not forget that the country needs different kinds of teachers, at different levels, with different skills, with different timings for performing different tasks to attain very different types of instructional objectives.

The global term 'teacher' has created this confusion. Rather than designing teacher education with this global undefined vague term teacher, it is necessary to start with job analysis, to segregate different tasks which are included in that omnibus term 'teacher'. In the medical profession, it is clear that a general physician is not the same as a physiotherapist who is not the same as a nurse or a chemist/pharmacist and so on. Each of these vocations requires different clusters of cognitive abilities, skills and attitudes. Is it possible to take up an exercise for separating such clusters of competencies in a teacher's profession ?

What is the cluster of competencies required by a professor of Physics in Delhi University and a high school teacher in a Delhi public school? In what way are these competencies different from the Anganwadi worker (pre-school programme), usually a lady from the same village or, for that matter, a tailor who works as a teacher in

TRYCEM Scheme, or an instructor in a community polytechnic, who do extension work in rural areas?

There are a few attempts to design teacher education curricula on the basis of systematic job analysis particularly in the sector of technical and management training but, by and large, the designers of curriculum and members of board of studies are not aware of or, if aware, do not practise this methodology. The largest sub-sector of teacher education, viz., the B.Ed, degree course, can be taken as an illustration. It may be noted in the very beginning that a few teacher educators feel that some diluted version of the present day B.Ed course is good enough for university teachers also. They also feel that the products of these B.Ed courses can work as inspectors/supervisors, guides and directors in the field of primary or pre-primary sector. The thinking which suggests such shortcuts is based on the false belief that what is good for a large sector of teacher education is good for any other sector without any attempt to work out the differences in the clusters of competencies required.

Ineffective B.Ed. Programme

But then, is the present day B.Ed. design effective at least for that sector—namely in providing competent teachers for middle and high school levels ?

Most of the meetings/seminars at the national level have concluded that the present B.Ed. programmes do not provide pupil-teacher competencies required to work in schools. The students in these programmes aim at passing the paper pencil tests at the end of the course, rather than acquiring the relevant skills. The so-called intellectual atmosphere in these colleges is conformity-imposing rather than innovative; the social atmosphere more individualistic and competitive rather than cooperative and involving pupil-teachers in the community/environment around the college (Gupta 1984).

It may be noted that although the diagnosis is correct—the patient is dying—the prescription given in many of these seminars is the same or similar medicine—only more,—length and duration of the training to be increased.

Sometimes the blame is laid on the faulty selection resulting in getting the teacher trainee who is low in intelligence, low in school achievement etc. In that context, some of the teacher educators and many education administrators are also worried about women joining the teaching profession. They attribute the ills of teachers' colleges to this infiltration of women. Research in this country and abroad has demonstrated that the correlation between effectiveness as a teacher and intelligence is not always positive and certainly not very high; this is particularly so at the school level as distinguished from the university level. The same is the case regarding the correlation between academic achievement by the teacher in his student days and his effectiveness. It is, however, a common finding that a teacher's positive attitude towards teaching, his own self-concept, his concern for others, and his enthusiasm, has an influence on pupil's learning.

In other words, the solution to stop the declining trend of teacher education may not lie in getting highly intelligent people into the profession, but in helping those who come to the profession to develop their self-concept, their concern for others, their positive attitude towards the profession. Just as every general physician does not have to be a high-level scientist, every school teacher does not have to be a high-level subject-matter expert. He should have a regard for the subject-matter, for himself and for his students. It is, however, absolutely essential that a teacher like a physician should be supported by other scientists and technologists in producing the teaching-learning materials and by the society in general to produce conditions which facilitate learning.

It may also be noted that women who enter the teaching profession are not less intelligent than men joining that profession. They, of course, have certain difficulties arising out of their commitments to other roles such as mother, housewife, etc. What is required in such a situation is to change the structure of the education system to facilitate women working for the system. Changes like part-time and flexitime teaching jobs, women working as producers of instructional materials, tutors, home visitors and in various other roles which fit in with their competencies and with the time they can spare after taking care of the family responsibilities which are equally important for nation-building purposes. But this is a separate subject which needs to be discussed in a separate paper.

Why the B.Ed.Programme is a Failure

Rather than putting the blame on the input of the system—the pupil-teachers' background, etc.—an educational technologist would study the process—the teacher education programme for its appropriateness.

An outside but sensitive observer of the system, Prof. Satya Bhushan (1984) in one such seminar said, "Why do our best possible and properly planned teacher training programmes not create the desired impact in the field?" I think this is the most important problem related to the teacher training programmes in this part of the world. Probably, the answer is that we have inherited a system where memory-based knowledge is given the highest place of respectability. Now, in such a society, we are trying to bring about a basic change—development of certain critical rational abilities in teachers as well as in the students so that they understand their environment and change their own educational behaviour.

Another reason is that our teacher training programmes are theory-based. There is very little of practice. The so-called teaching practice itself, is so to say, a farce. To strengthen my observation, I give you an example. Five years back when I took over as Commissioner, Education, J & K State, there were about 7,000 teachers at the Secondary level who were untrained. They did not have the B.Ed. degree. I was advised that unless and until a person has got the B.Ed. degree he cannot become an effective teacher. Obviously, we could not bring them to the formal institutions for one year. In order to entitle them for the B.Ed. degree we thought of some sort of strategy. It was in the shape of a sandwich course so that they could overcome their deficiencies. I moved into the Colleges of Education, mixed with the students and asked them as to how many days they attended the classes during the last nine months or so. I studied the statistics for five or six years and found that in a 9-month session, there were hardly 90 working days and that too in the best of circumstances. I asked the students what kind of material they studied. I interviewed the first divisioners also and they replied that they were studying a helpbook worth rupees twenty-three. Strengthened with these statistics, I started capsule courses of three-month durations. The examiners were the same as those appointed by the universities for setting papers in the B.Ed. courses. The courses were the same; the standards were the same. The duration of the course was only 3 months in contrast to the normal course of 9 months. And the results were better than the regular B.Ed. students.

Dr. G. Kakkad (1986) from Nagpur University who has done a systematic study of all the B.Ed. curricula and practices in teacher education at that stage also finds that the present-day colleges of teacher education are not producing teachers with teaching skills required to work in schools of present and future India. He also emphasises that the skills required by teachers working in urban areas are different from those working in rural areas and hence suggests different curricula for these two sub-sectors. Many similar attempts of diagnosis are in the right direction, but not sufficiently incisive and comprehensive because they too, do not follow completely the educational technology approach.

Broad and Narrow Meanings of E.T.

What is the E.T. approach? For some, educational technology means the sophisticated gadgets, like computer, television, radio, film, projector, etc. The words "educational technology" does include the use of these gadgets—the products of engineering and physical sciences, but the term E.T. means much more. E.T. in its comprehensive sense is concerned with learning, by whatever methods and media. It is with analysing the systems of education and designing more effective systems involving both human and non-human resources which would ensure more efficient and more relevant learning. The term E.T. in other words stands for an approach to study, improve, innovate education - teaching-learning process, so that an individual learner or a group of such learners achieve the desired objectives more efficiently and effectively. Here the term efficiency refers to the saving of time and cost resources utilised in the process and effectiveness refers to the quality and level of the objectives achieved at the end of (or at different stages in) the process.

Objectives of the Teacher Education Programme

From this broad framework of educational technology, teacher education can be considered in four components:

1) Objectives of teacher education based on job analysis
2) Curriculum : content and design
3) Instructional Process : teaching-learning process, methods and media.
4) Evaluation : pre-entry, during and at the end of the programme and in the field.

The first step is a thorough job analysis and role analysis. The job of a producer of television lessons of high school physics, the job of a physics teacher in an urban school, the job of a physics professor at postgraduate level, the job of a science teacher in a rural school, are all different. There are certain commonalities, but there are many important differences and therefore the cluster of competencies required to perform that job are necessarily different. Add to these the obvious differences in these jobs, the different patterns of behaviour required in the job of a teacher in a non-formal institution who is to prepare self-instructional materials or conduct tutorials, face-to-face discussions, or provide remedial instruction, or a part-time teacher who could be a para-professional coming to the system to assist the professional teacher in his attempt to individualise education.

Is our present day teacher education programme based on an explicit analysis of these different patterns of behaviour? Even an attempt towards such systematic analysis is not reported and whatever little effort in improving the teacher education programme is made, even by national bodies, assumes an omnibus concept of a teacher which in turn is heavily biased in favour of a high school teacher's role in an urban school on a formal education pattern.

Even in that limited context what should be the objectives of a teacher education programme if we derive these objectives from the role a teacher has to play in an urban secondary school ?

These could be stated as follows:

The teachers should have

(i) a wide range of conceptual understanding of more than one subject so that he/she can assimilate new knowledge (the demand in this era of knowledge explosion).

(ii) intellectual skills to handle new and unforeseen situations when students would raise questions which may not be based on text-book content.

(iii) a constructive critical attitude towards educational innovations and change and a certain degree of willingness to experiment with new media and methods.

(iv) keen sense of belonging to the society/community in which the school is located and with the nation at large.

(v) a mature adult personality so that they will encourage independence and mature behaviour among their students.

(vi) inter-personal skills so that they can generate a cooperative atmosphere among their colleagues and provide stimulation to their, students' intellectual and emotional growth.

(vii) communication skills which facilitate the learning process of their students.

But then, can these objectives be achieved by minor modifications in the present day B.Ed. curriculum; by changing the titles of the papers from 'philosophy of education' to 'psychological and sociological foundations' or a recent title like 'teacher in an emerging Indian society' or by introducing some new papers ? The basic change will have to do away with the division between these "papers" which are called theory papers and are given weightage much higher than the practicum. These so-called theory papers after deleting redundant section would have to be integrated with the practicum. A good or effective teacher is one who uses methods appropriate to learners and inspires them.

One of the major defects in the design of the present day curriculum is that it is a mechanical assembly of units/papers rather than an organic entity. Every paper (and in many cases different units in that paper) is taught without relating it to other papers/units and to the role a teacher has to play. The instructional process further enforces the division. Example, What is taught in the paper on Evaluation, say about desirability of continuous assessment, objectives based and objective type items, immediate feedback etc. has no impact on the type of assessment in other papers—unfortunately even on the assessment of the paper on evaluation itself.

Broad Design of Teacher Education Programme

A broad scheme of a teacher education programme which is flexible as far as the time dimension and sequence dimension is concerned, can be formulated on the following lines:

The emphasis in this programme will be on skills and attitudes and not on the so-called theory. The broad objectives referred to above can be divided into the following four clusters of observable/measurable behavioural skills:

(A) Skills—from both cognitive and effective domain—required to play the role of a facilitator of learning process (Facilitator in terms of Carl Rogers, Midwife in terms of Socrates). These would include among others

(i) interpersonal skills based on the understanding of teaching learning process.
(ii) skills of a communicator who presents a message, checks whether the learner has received it, modifies the message or the channel as and when necessary.
(iii) skills of an organiser/manager of learning resources both human and non-human, who arranges/provides them to the learner as and when necessary (e.g. Human resources : Other learners, parents, expertise in the community, etc,; Non-human resources: books, work books, radio, television, computer, etc.)

(B) Learning skills to learn any new subject matter which he is likely to teach/expected to teach. (He cannot rely on knowledge/ information he has obtained in his school/college days.) These would involve skills of reading with comprehension, using a library, interviewing people, classifying information into different sets of categories, generalising, assessing data sufficiency and relevance, interpreting data etc. (and for tomorrow's teachers computer literacy, if not, computer programming).

(C) Skills of producing instructional materials—handouts, exercises, audio-visual materials etc. relevant to the subject matter he is going to or likely to teach and to prepare tools of assessment, diagnostic tests and achievement tests. This will also include skills in using mass-media like radio, television, etc., and producing materials supplementary to their messages like tests, assignments, simulation exercises, etc.

(D) Skills related to a particular subject matter, e.g. for a science teacher, performing experiments in laboratories; for a history teacher, skills of reading and interpreting old documents, etc.

Of course all this implies his mastery over some subject matter/ content of some subject. But this mastery does not mean that he is an expert in that subject. In terms of his fund of information in a subject he could be just a few steps ahead of his learner, but he must know the source from which he can get information, and he must have the

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conceptual framework in which such information can be assimilated, and of course the learning skills to gain new knowledge in that subject. The present obsession of increasing the length of teacher education programmes can be partly explained by the perception that when a pupil comes to the teacher's college he is seen as weak in any subject area even when he has bachelor's or sometimes master's degree in that subject. Even his first class is no sure guarantee of his subject matter expertise. But then can the teacher's colleges give him the subject matter expertise by adding content courses in their syllabi? The basic defect of both the degree colleges and teacher's colleges in this respect is to equate giving information, some facts and events as giving knowledge, and still worse and a more dangerous assumption that lecturing by a teacher would automatically lead to listening by a learner and that just listening would lead to learning—understanding, applying analysis, synthesising by the learner.

Suppose it is presumed that teacher's colleges succeed in providing the content of some subject matter to the pupil trainee. But then where is the guarantee that the pupil teacher, when he becomes a teacher in a school, will be using that content alone ? He may be a physics graduate, but required to teach botany and vice versa. In some instances language teachers are required to teach geography and even science and vice versa. And these cases are not going to decrease, in fact they will increase because of the diversity of courses which schools have to introduce and shortage of people trained in those specified branches of a discipline. There are many rural schools where there are no teachers with a graduate degree in Science, and there will be many schools, even urban, where there will be no teacher with a degree in Nuclear Physics, Marine Biology or Cultural Anthropology etc. What is essential then is that our teachers have the skills to learn new subjects, maybe along with their own pupils, from library, laboratory and community sources. This is not to deny the desirability of subject matter expertise, but to question the assumption that all the information, knowledge a teacher requires throughout his life must be provided in the teachers college. Just as it is necessary to re-examine the omnibus concept of a teacher, it is also necessary to examine the one-shot training strategy. Many in-service programmes will have to be designed which a teacher can attend at different stages in his life to play the different roles that he will be expected to perform.

Based on such a strategy of teacher training which includes pr

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service and in-service training which leads to successive development in his skills and content competencies, one can design a pre-service training programme somewhat on the following lines.

Important Modules in the Teacher Education Programme

There could be five modules in this programme:

Module 1 : *Self-exploration and relating on self to society*

There will be three objectives of this module:

The pupil-teacher will be able to :

(A) diagnose his own strengths and weaknesses and plan for increasing his strengths and reducing the weaknesses (refer to SWOT analysis). In this process he will feel more confident about himself (his self-esteem will increase) and he will be able to receive more constructive feedback from others.

(B) apply the principles of modern pedagogy to the teaching learning process he organises in the classroom environment. In this process he will develop interpersonal skills including listening to others, respecting others as individuals, encouraging learners to be independent and provide them non-directive counselling (refer to Carl Rogers).

(C) involve himself in social/community work with a sense of belonging to the members of the community. In this process, he will be able to identify services which the school can provide to the community in which the school is located and organise some of the activities towards rendering those services (refer to Mahatma Gandhi's concept of Basic Education).

To achieve these objectives, methods like sensitivity training, micro-labs, T groups, transactional analysis groups will be utilised to provide opportunities to students to look at themselves, to understand how others look at them, to receive feedback from others and decide about one's personal growth. In addition to these methods, field experiences like surveying the community, working in non-formal adult education programmes or rural development programmes should be arranged. Case study discussions on films like 'Manthan' or 'Ardhasatya' or certain parts of video series like 'Humlog' can be used in this context. Some of these experiences are even now arranged in some training colleges as extra curricular activities. The argument here is that these experiences should become the major component of the curricula, while listening to, or reading about philosophical foundations, etc. can become supplementary to analysing and integrating these experiences to help a pupil teacher to understand himself and relate himself to the society in which he is living. Non-directive counselling sessions will also be organised to acquaint the pupil-teacher with those techniques.

Module II: *Skills for learning a new subject*

The objective of this module is that the pupil teacher will be able to learn a subject on his own by using a variety of learning techniques and resources, and will be able to prepare lesson plans to teach that subject.

As noted above, a teacher cannot rely on his Bachelor's Degree or the information/knowledge he has obtained for that degree. He has to continually update his knowledge from sources other than guides/ notes written by his teachers or passed on to him by his peers. The role of a good teacher in any subject area is that he makes his students capable of working independently.

In order to fulfil that role, a teacher must master the skills of how to learn on one's own.

Another label for this cluster of skills is research; discovering new knowledge, creating new knowledge for one's self. At present in some of the M.Ed. courses there is a paper on research methodology. But again it becomes a "paper", not a skill-building exercise. Most of the time this paper means learning some formulae regarding descriptive statistics and a few methods of data collection. There is very little problem identification, problem analysis, interpretation of data from various sources—particularly when data is conflicting. Many times even our Ph. D students are not required to go through such exercises. But it is possible to get these kinds of exercises worked out in high schools or for that matter even in primary schools.

Research is not the monopoly of a few Ph.Ds. The approach of a researcher, of a scientist—not necessarily high level statistics, and sophisticated methods of performing experiments—can be taught at the teacher college level.

One of the many ways to get a pupil teacher to learn skills of learning (or researching in this broad sense) is to ask him to prepare lesson plans/topic plans in subject areas which he has not studied at the Bachelor's Degree level. At least some subject/part of the subject he has to study on his own and present his understanding to his peers through the process of summary reports, demonstrations, lesson plans, essays, etc. Many themes relating to environment can be taken up for study in this context, including the socio-political history of the community where the college is situated or from where the pupil teacher comes, its ecology, social economic environment, physical environment etc. There need be no bar on library research, because the library is a great resource, but somewhere he should be encouraged to find out that the community and the environment around is also a great resource.

Module III: *Teaching methodologies*

The objective of this module is that the pupil-teacher will be able to select a teaching method (or combination of methods) and media relevant to the instructional objectives of the subject he plans to teach and appropriate to the students' behaviour.

There are many teaching methods from the present day teacher education programme which would fit into this module, but with some difference in orientation and of course with many additional methods. If one classifies the teaching methods used in formal education in this country, one can divide them into four categories :

Category A	Presentation methods (One way communication)
Ai	Lecture without any aids
Aii	Lecture with other visual aids, e.g. chalkboard, models, charts, overhead transparencies, studies, etc.
Category B	Methods involving interaction with human resources
Bi	Interaction between teacher and students. Question-answer sessions between teacher and students but all the initiative and control with the teacher.
Bii	Interaction between teacher and students and also among students; lot of initiative with students, joint exploration;, students becoming participants and not just listeners. Methods like group discussion, case studies, syndicate methods, role plays, etc.
Category C	Methods involving interaction with non-human resources, e.g. methods like self-instructional

programmed learning materials in print or audio-visual format, television lesson computer assisted instruction, etc. In this situation a teacher is not physically present. Usually such materials are not produced by a single teacher, it is usually team work and requires varying degrees of competence which is at present not taught in our teacher's colleges.

Category D Combination of Category B and C, namely interaction between both human and non-human resources, e.g. methods like group programmes involving programmed materials and supplemented by group discussions guided by a tutor, television lessons plus teacher-guided discussion, business games etc.

At present most of the teachers' colleges are spending a large percentage of time on Category 1 methods. There also, use of overhead transparencies or slides or films is a rare phenomena. They are still conditioned to a teacher-controlled presentation model. They do not think learners can be participants in the joint exploration of learning together where the teacher is a learner. This has influenced even our television instruction. There also, more time is spent on a lecture by a human presentor of information rather than by visuals explaining the subject. This has affected even our microteaching movement. The skills taught through these sessions are those of a presentor of information, at the most, some questioning skills. In the questioning skills again, the questions asked are of a lower order, e.g. the information type; and not of a higher order, e.g. eliciting reasoning, creating or evaluating by learners. The lower order questions make learners reproducers of information, not producers of knowledge, not thinkers, innovators or evaluators. The interaction models—Categories B,C, and D are more amenable to these higher order goals of education.

The shift from Category 1 to higher categories has to start from teachers' colleges themselves. In a study in M.S. University, Baroda, Dr. Yadav and his colleagues found that the subject on evaluation and related statistics can best be taught by programmed learning materials supplemented by tutor-led discussions. They prepared a total package, but very few teachers' colleges in this country even know about these experiments, far from using the package, which not only is more effective in terms of students learning, but also saves time, both of learners and teachers.

In the context of teaching methodologies, it is necessary to get an important message across that a teacher is not a lecturer. Lecturing is the last resort, when no other method or medium is available. A teacher is primarily a manager of learning experiences. He has to get different media (not necessarily expensive gadgets), various human or non-human learning resources assembled around the learner with the help of which the learner would learn. Such learning sources would include newspapers, a shopkeeper, a neighbour who might be working in an industry or on a farm, a doctor or a scientist in the community, a radio, a television and many similar sources including parents, even if they are illiterate, and of course the learners themselves.

Teaching methodologies taught in the teachers' colleges should include methodologies referred to in the categories B,C and D in addition to those referred to in A, and the teacher educators must themselves start practising them rather than again lecturing about them.

One difficulty that is often mentioned is the size of our classrooms. The 1 teacher to 20 students ratio which was present in some British schools some decades ago is referred to again and again as the ideal ratio required for any improvement. But then are methods other than lecturing (Category A) used even in classes where the student ratio is less than 1 to 20? The real difficulty is not that of the ratio but our refusing to produce individualised learning materials or use media other than the teacher. In the primary education sector, there are many schools which are single teacher schools (nearly 40% in many states) where the number of students is not very large but they differ in ages, in their levels of education, in short, in their training needs. But then, in how many primary teachers' training colleges, methods of individualising learning processes or of group learning are taught? How many of our teachers' colleges experiment with such methods? How many University Departments of education have provided or used programmed learning or similar materials like the M.S. University material referred to earlier?

In fact, the urban classroom area should be a larger one, as it is in England or the USA. The heterogeneity among the students is bound to increase, not decrease, because of the incidental learning taking place outside the classroom. Under these circumstances to dream of 1 to 20 ratio and refusing to think of possible alternative solutions is an absurdity. It is precisely because we are going to have large classes that we have to think of new methods from Category D — using human or non-human resources. It is necessary to get on the one hand parents to work as para-professionals and on the other to explore possibilities of getting mass media to serve individual learners. Just as the book has brought the lecturer-subject matter expert under the control of a learner, he can study it at his own pace and location; the audio cassette can bring the radio, video cassette, and television under the control of the learner. It is the teacher's job to help this process, by identifying resources, diagnosing the individual learner's needs and counselling him about which resources he can use, providing him remedial measures or supplementary materials as and when required.

It may be highlighted here that assessment for instructional purposes or diagnostic testing for remedial instruction and also for improvement in teaching learning methodologies is an integral part of any category of teaching methods. In our country at present examinations are seen only as an exercise for ranking, promotion to higher grades or selection. When we integrate examination with teaching, it should provide feedback to both learners and teachers/managers of teaching learning process. The assessment tools should give specific—not global—information to a learner regarding his achievement and/or failure, his strengths and weaknesses. The same information should provide clues to teachers - producers of instructional materials regarding their effectiveness where they should change their methods, revise their materials, etc.

In this and other modules the pupil-teachers will be assessed with such tools, and in this particular module they will be taught to prepare such assessment tools as an integral part of teaching methods.

Module IV : *Microteaching*

Microteaching is like a rehearsal which gives suitable feedback for modification of behavioural skills.

Many teachers' colleges have adopted microteaching but some are going through it more as a ritual without understanding its relation to broader behaviour modification strategies. As noted above one can use this strategy for skills of a lower/higher order. But in both cases specificity of feedback is critical. Most of us as supervisors or inspectors are conditioned to give global assessments, good or bad, but not specific information regarding the impact teacher behaviour has on the learner. In future video facilities will be made available in teachers' colleges providing opportunities to the learner to see his performance and improve it. But in the meanwhile his peers, friends in whom he can trust, can provide him data. The important thing is both the learner and his peers should learn to observe and seek and provide relevant specific information, not assessments. From this perspective the earlier the title of supervisor or inspector of lessons is dropped the better it will be, because with these titles the person adopts the superior role of a judge, not that of an informer. In microteaching exercise evaluations of the conventional type are not needed. What is needed is corrective feedback—information based on which a learner can decide his own action plan.

Microteaching can also be used as an integrative exercise. In this form it is a simulation exercise and is different from real field experience like block teaching. Being simulation exercise it provides the facility of moving step by step from simple to complex, ensuring success experience as in programmed learning. Complex skills need to be broken up to enable learners to master them step by step ensuring success at every step.

How many microteaching lessons should be provided ? In boards of studies, this seems an issue for much debate. In a way this is an irrelevant issue, once we get ourselves out of the trap of treating every lesson as a classroom group exercise. Microteaching is essentially an individualised or small group learning experience. One may require ten hours to practise and master a particular skill which another may master in two hours. This is known to any person who might have taught swimming or driving a car to his son. But in the university syllabus committees, this simple truth is sacrificed at the altar of uniformity and equivalence between degrees.

Module V : *Block Teaching*

This is the final integrative exercise. But, integration of what ? At present, even the block teaching exercise does not provide a pupil-teacher with the opportunity to integrate methods of Categories B and C; at its best it becomes a testing ground for assessing his skills in Category A methods and to some extent Category B.

Another dimension is the different kinds of schools a pupil-teacher is likely to work with after his degree. The problems of the community and environment in and around a school are going to be different from urban and rural schools and even in urban schools those in public schools and municipal or other socially disadvantaged schools.

Is it possible to help a pupil-teacher to integrate his methods with the kind of school system he is likely to work with or at least to make him aware of the problem of relevance ?

Another important practice which would help a pupil-teacher in the field is team teaching. They have to learn to supplement and complement other teachers — professional and para-professional. How to do that ? At present, models of team teaching are not provided in most training colleges. But they need to be provided and then practised at the time of block teaching exercise.

These and many similar issues need to be discussed at the time of block teaching. There need be no final solutions. The teacher educator, of course, does not have the responsibility to solve the social and economic problems and evolve all appropriate strategies. But, can he help a pupil-teacher to see the problems and to explore alternative tactics to deal or at least cope with them ? What is suggested here is not exactly new. Hebalkar (1984) reports a case study of need based curriculum for the Bachelor of Education course evolved by teacher educators in Madhya Pradesh (in 1980). The programme includes internship in two phases.

Phase I: Teaching in rural and urban schools (at least four periods per day per pupil-teacher, and Phase II : Attaching pupil-teachers to schools for six months' duration. In this programme much emphasis was on community work and work experience. This programme also involved team teaching which is usually neglected/not even talked about in most other programmes. This need-based syllabus was given a trial in the Govt. College of Education (Ujjain, M.P.). But then such experiments of integration are very few and even in this programme Phase II of internship had to be dropped due to administrative and financial reasons. What becomes critical in such integrative exercises in the field is the support of several systems outside the college, e.g. the schools and the cooperating teachers who should have the skills in observing and giving appropriate feedback to pupil teachers, the community and government agencies to provide logical facilities, the sponsoring organisations to provide necessary finance. It is, of course, not easy to assure these supports to every teacher's college. But, here again, the problem may be like deciding whether Mohamed should go to the mountain, or the mountain should come to Mohamed.

These five modules will ensure the four clusters of skills (A,B,C,D) referred to earlier. The skills referred to in cluster A, i.e. for the facilitator's role and in B, i.e. learning skills are common to teachers at all levels Primary to University, in all sectors—formal and non-formal—although the expected degree of their attainment may vary. Weightage given to skills referred to in clusters C and D, may vary from sector to sector but some elementary skills included in those clusters are necessary for any teacher. Hence, any secondary teachers' training programme should have all the modules in some form or another. In addition to these modules certain other modules will be required depending on the entry behaviour of the pupil-teachers and specific roles they are expected to play in their jobs after the programme (i.e. terminal behaviour). In other words, a module on how to develop sophisticated instructional materials, e.g. P.L., materials, slides, tapes, kits, courses to help the pupil-teacher achieve a certain mastery level in subject matter etc. would have to be added to make this programme effective.

Duration Required for Teacher Education Programme

As noted above, Prof. Satya Bhushan developed a capsule programme of 3 months' duration which enabled the teachers to get a B.Ed. degree achieving higher scores than those who took the usual one-year programme. In many industries including banking we have found that officers can manage to learn the skills referred to above (particularly in clusters A and B) in about 3 to 4 week's course. Thus, there is nothing sacred about one year or two years' programme. Teacher education programmes may range from a few months to two years depending on the entry behaviour of the candidates and the expected terminal behaviour. The modular approach now accepted by Indira Gandhi National Open University will enable teachers to take programme geared to the specific competencies they would like to learn. Towards this end one may re-examine the necessity of an omnibus pre-service programme. It may be possible to arrange a short pre-service course, then get into a job and come back for additional specific modules as in-service programmes. The open university model towards which we are moving should facilitate this combination of pre-service programmes. In Pune district (Maharashtra), this combination has already been demonstrated to be very effective as far as the pre-primary teachers' training is concerned.

Anyway, the debate on the duration of the programme should be conducted only after explicit statements of objectives - terminal behaviour and the methods to be used and not in terms of what other professions do for their conventional university degrees.

Technology in Teacher Education—Media and Aids

So far what is presented is an illustration of applying some aspects of E.T. to education of teachers at high schools level. This was, in other words, an application of a systems approach to that sector of teacher education. This section describes the possible uses of products of modern technology in this sector.

Although it is true that a sizable number of primary schools do not have even a blackboard, most teachers' training colleges are operating in urban areas where there is electricity and many of them have a slide projector, a radio, a tape recorder and are in a position to get a television. With the Government; or Parent Teachers Association's assistance, some of them may even manage to get a computer in the near future. In the 1960s, when with the help of USAID and other donor agencies, schools were provided with projectors, many of those were not used because school teachers said they did not have films or slides to show. Is that performance going to be repeated with television and computers ? Are the radio and television going to be used only for recreational programmes (Hindi films) and computers only for administrative purposes ?

There seems to be very little effort on the part of teacher training colleges to use these media or aids now available for educational purposes. Yes, much can be said about improvement of radio or television programmes. But is there absolutely nothing that schools can use ? There are two major difficulties. One, that schools are still not prepared to move from category one methods—namely presentation to Categories II and III involving interaction with human and non-human resources other than a teacher. The second difficulty is that at present schools have less control over the timings of these broadcasts. The second difficulty can be overcome by tape recorders and audio cassettes in the context of radio and video cassettes recorders and video cassettes in the context of television. Universities and schools should be encouraged by Doordarshan and other Government authorities to record and use their education programmes and even parts of their recreational programmes like the serials 'Humlog' or 'Adhikar'. Some of these can provide excellent material for discussion in teacher education programmes for understanding the environment. Programmes like Krishi Darshan can also be video taped and those that are not required any longer can be erased from the tape, and other programmes recorded. In other words, Teachers Colleges should develop their own library of books as well as tapes both audio and video. Although it is ideal to have these libraries in air-conditioned rooms, it is not absolutely necessary, if it can arrange to keep these rooms somewhat dust-free.

Computer Aided Instruction

As regards the computers, the usual criticism is that we shall not be able to provide learning time to all students because of the shortage of terminals. So what is not available to everybody should not be available to anybody. Although it is necessary to find out ways of making personal computers available to a large number of students for learning a variety of tasks, it will take sometime—maybe a decade, in the meanwhile possibilities should be explored for using the presence of a computer system to get people to think in a more systematic way.

For example, it is possible to construct detailed diagnostic tests for each subject, put them on a computer system and encourage students to assess themselves by taking tests. It is also possible to get students to prepare algorithm, flow charts and similar sequential process charts, on very simple themes like cooking a particular dish to a complex business decision. Even pre-primary and primary school children can be engaged in such exercises. Here computer time is not involved. The presence of the computer somewhere in the premises of the school/college can be utilised as a motivator. But for this, the beginning has to be made in teachers' colleges of education. By itself the radio, television or a computer would not teach, but a teacher in his role as facilitator can use this technology as a useful source for learning, and get his students to interact meaningfully. All this is creative, innovative work and our teachers are competent to undertake it.

Strategies Required for Implementation

Who should initiate action ?

The programme suggested here (consisting of five modules) is not foolproof and needs further development. The only justification for suggesting it is to start a debate—a brainstorming among educators by applying the systems approach to this critical field of teacher education. There are many more aspects of the total strategy which are not mentioned in this paper but which need to be discussed and worked out. For example, a strategy shall have to be designed for getting the university boards of studies and then the large number of teacher educators convinced and equipped to conduct new programmes. It is true that very few systems change without feeling any pressure from outside; the inertia of a system and the entrenched vested interests (like some of the boards of studies, the old textbook writers, etc.) would try to stop any movement in the new direction. At the same time it is true that if a system is forced to change only by applying external pressure it is more likely to break than gear itself to achieve new goals. This is a dilemma for any management for change. The situation in the field of teacher education, however is not that hopeless. There are adequately strong forces from within the system who are on the side of change. If these forces are identified and encouraged by the outside systems like UGC, the overhauling of the teacher education system can be managed.

There are about 500 teachers colleges throughout this country which means about 5,000 teacher educators. It is possible to conduct orientation programmes for them in a phased manner. For conducting such programmes panels of "facilitators" (not lecturers or ex officio experts) can be formed from the various management institutes, training systems in industry, university departments of psychology and education, and very important, from progressive schools where methods of Categories B, C and D are already being practised. These orientation programmes for teacher educator should not be lectures but should reflect the learning environment emphasised in Module I.

Later one should also try to persuade/force the board of studies to change the curricula and the examination system, which in turn will provide the necessary momentum for the teachers' colleges to change their design and practices of both B.Ed. and M.Ed. degree programmes. Many persons from outside the formal sector of teachers' colleges would have to be involved in this movement like the producers of mass media, enlightened parents, union leaders, etc., to make the movement more socially relevant and also to provide it the moral support it requires.

In brief, a network of activities would have to be developed linking internal sub-systems and external systems supporting teacher education. Organisations like NIEPA (National Institute of Educational Planning and Administration), All India Association for Educational Technology can be given the role of designing such a network.

Financial Resources

What would be the magnitude of financial resources required for such a change, and for getting the teacher-education system to work in cooperation with other systems ? One may point out a rule of thumb.

No educational system can function properly if 90 per cent or more of its budget is spent on salaries and other establishment costs. At higher levels of education more than 20 per cent of the budget is desirable for programmes. Some of these financial resources can be generated from the community, for services rendered. For this purpose, a certain degree of autonomy should be given to educational institutions. The network concept referred to above will also help in exploring hidden resources, both financial and human.

These and many other important aspects of the strategy like the composition of staffing in teachers' colleges, the common services required for these colleges to sustain their momentum and their location, etc. also need to be worked out. But all these problems can be overcome once the direction of change is accepted by the policy decision makers and the national level opinion builders (i.e., the leaders in the Government and leaders in bodies like UGC, NCERT, etc.).

Plea for Onward March

The exercise described here is only a beginning, just to demonstrate the desirability and feasibility of applying the educational technology approach in both its broad and narrow sense to the sector of teacher education. One can do similar exercises for other sectors, primary education, university education, adult education etc. One can, by using this systems approach design more efficient and effective strategies to solve certain types of problems in each sector of education. And they have to be solved.

In this exercise, in this adventure called education, educational technologists have to join hands with many others, educators, economists, sociologists, psychologists, producers of mass media, opinion builders, parents, in brief all those who shape policies for tomorrow and help in policy and strategic planning and in its implementation.

Such a cooperative venture based on systems approach can solve most of the educational problems faced by the country and will enable it to march into the 21st century with greater confidence and competence.

Works Cited

Gupta A and Patani R, Teacher Education Today : Some Bitter Truths, in Gupta A K (Ed.) 1984, *Teacher Education: Current and Prospects*, Sterling Publishers, New Delhi. Also in the same book Gupta A, Overhauling Teacher Education - How?

Habalkar Indu, Need based Curriculum for the Bachelor of Education Course, in Gupta A K (Ed.) 1984, *Teacher Education: Current and Prospects*, Sterling Publishers, New Delhi.

Hoyle E and Megarry J (Ed.), 1980, *World Yearbook of Education: Professional Development of Teachers*, Kogan Page, London.

Kakkad G, Secondary Teacher Education, *Direction of Change in Bharatiya Shikshan*, Volume XIX, No.1, Jan.1986.

Ministry of Education, (Aug 1985), *Challenge of Education - A Policy Perspective*, Ministry of Education, Government of India, New Delhi.

Satya Bhushan, Teachers Education in Jammu and Kashmir, An Administrative Dilemma, in Gupta A K (Ed.), (1984), *Teacher Education: Current and Prospects*, Sterling Publisners, New Delhi.

3

THE INTERNATIONAL DEVELOPMENT OF EDUCATIONAL TECHNOLOGY : LESSONS FOR THIRD WORLD COUNTRIES

Anjana Mangalagiri

The NPE (1986) has emphasised the development of media and educational technology as a vital input for improving the quality of education at all levels and for all. Modern communication technologies, as the document states, "have the potential to bypass several stages and sequences in the process of development" whereby "both the constraints of time and distance at once become manageable." It is this unique character of technology that has to be harnessed to enable education to reach out to the most distant areas and deprived sections, in order to avoid the structural dualism in India. In accordance with the policy document, the programme of action, therefore, outlines its target areas, priority measures and the strategies envisaged to build up a network of systems of educational technology that would be employed in the spread of useful information, training and re-training of teachers, enrichment of curriculum exposure and training in the use of computers for enhancing teaching-learning processes, etc., both in formal and non-formal sectors of education.

In the light of this background, the present paper attempts to critically evaluate and assess the development of educational technology in the international arena to highlight and draw upon the experiences of developed and Third World countries in the field in order that lessons can be learnt in terms of choice of technology, socio-economic implications and costs and the management considerations thereof, in packaging programmes.

Development of the Concept of Educational Technology

For purposes of clarification, it is important to first understand in broad terms, the meaning of the concept of educational technology (ET). According to the National Council for Educational Technology

(London), ET is 'the development, application and evaluation of systems, techniques and aids to improve the process of human learning'. G.O.M. Leith has attempted a more detailed definition: Educational technology is the application of scientific knowledge about learning, and the conditions of learning, to improve the effectiveness and efficiency of teaching and training. In the absence of scientifically established principles, ET implements techniques of empirical testing to improve learning situations. Thus, ET is concerned to provide appropriately designed learning situations which, holding in view the objectives of the teaching or training, bring to bear the best means of instruction. The means of instruction implied may involve modifications of the learner's environment through techniques of presentation, arrangement of learning activities and organisation of the social and physical surroundings.

The means of presentation (hardware) such as CCTV, language laboratories and projection equipment are, of course, important aspects of ET so far as they make a controlled contribution to improving the effectiveness and efficiency of teaching and training. Such devices bring problems of economies, standardisation of equipment, choice of equipment, integration into the teaching system, training of teachers, role of ancillary staff, etc. They must always be considered as means to the attainment of educational objectives rather than as things in themselves. Only by knowing how to use hardware appropriately, can we change the efficiency and quality of learning to a significant extent.

Experience of ET in Developed Countries

The development of ET in the advanced, western countries however, according to Elton's model, passed through three broad phases—from mass instruction to individualised instruction, to group learning. Mass instruction had its genesis in industrial technology. The economy of scale was a necessity. The method used was extremely hardware-intensive: CCTV, CAL, communication satellites. This was not successful as for the first time it questioned the traditional role and pedagogic authority of the teacher in the classroom. Thus, there was a general resistance to the adoption of educational hardware by the teachers themselves. Also, school managements, having introduced the technology, did not simultaneously develop the necessary organisational structures to support such efforts. This either led to the misuse of the hardware or pushed the teacher back into the relative safety of traditional teaching. One of the causes for this alienation with technology was that ET was not a product or did not evolve from the needs of education. It was basically developed for other purposes in the industrial and scientific world. To that extent, education and training could seldom command more than marginal adaptation of equipment to its purposes, the basic design being undertaken with other ends in view.

The next phase was that of individualised instruction based on the theory of behavioural psychology adopted from Skinner's stimulus-response model, that if you provide the right stimulus, you get the right response. This led to a blossoming of education software: programmed learning, the Keller plan, and a variety of ranges of software all of which were designed to provide individualised learning where a student is fairly clearly directed through the learning process. However, this also had its limits, in that it was individual-oriented which made it difficult for the students to interact with each other, thus satisfying only fairly low-level objectives.

This took educational technologists to a third area, namely, group learning. Here the basis was a totally different kind of psychology, humanistic psychology. It showed how to go about teaching, so that people would react to one another. The method that needed to make people interact with one another required no special hardware, very little software, but it required techniques of group dynamics.

The theoretical basis of these three phases can be generated from and related to the three stages that education generally followed, viz., dependence, independence and interdependence, which are mirrored closely in the three types of instructional phases described above.

In mass instruction the students are totally dependent on the teacher for any form of learning that takes place. If, however, they are given some materials with which to study, then they become independent of the teacher and have an individualised form of instruction but not until they work in a group do they become interdependent. Here was the rationality for ET to move from mass to individual to group in the West.

The history of the British Open University provides an apt illustration of these three stages of growth in Western ET. It was inaugurated in 1964 with mass instruction through radio and television as its primary objectives. Five years later, the name was appropriately changed from University of the Air to Open University as it was realised that only about 5 per cent, if not less, of the instruction was through broadcasting. The remaining 95 per cent of teaching was through the post-box as individualised material. Over the next five years it became increasingly apparent that students were not quite satisfied with this alone. They desired direct contact with teachers and with one another. Summer schools, local centres, tutorless self-help groups of students sprang up and now there is a serious attempt to bring the human context and collective discourse into the structure of Open University. Although the Open University has always used all three models of teaching in its courses, there is no doubt that there has been a gradual change of emphasis over the years. Individualised learning has increasingly resulted in group learning. Gradually the collective context has played a much more important role than was originally envisaged. In its evolution, the Open University thus represents a microcosm of educational technology itself.

Two other areas not incorporated in the Elton model but equally important which have contributed to the development of educational technology, concern the management of innovation and the development of student study skills.

Most of the work of the educational technologist is, by definition, innovative. The effective management and implementation of innovation has recently been of increasing concern to the educational technologists as many highly promising educational innovations have been founded and forgotten because the implementation of the innovation was mismanaged. Increasingly now, educational innovators are spending much or even more time for fostering an educational environment in which an innovation can flourish as in developing the actual educational innovation.

Development of student skills is yet another area in educational technology that calls for improving the effectiveness of the teaching/learning process by increasing the efficiency of learners in assimilating the subject matter covered. Here, educational technologists and teachers have used the results of educational and psychological research to devise programmes of activities that are specifically designed to assist students in their study technique. Areas covered by study skills includes organisation of time, effective use of time, reading skills, essay-writing and report-writing skills, note-taking examination technique and even job-hunting skills. The growing interest in study skills development is further evidence that ET is concerned not only with hardware and software, but also with the less tangible aspects of the teaching/learning process.

ET and the Third World

The history of the growth of ET in the Third World differs fundamentally from that in the developed countries. The development of hardware, for instance, in the latter was a consequence of the advancement in scientific, technological and industrial development. Similarly, development of software was inevitably a direct function of the advancement in theories and techniques of education and teaching. In contrast, the growth of ET in Third World countries was not from within due to obvious reasons of backward industrial state, and a low level of scientific and technological development. It is no secret that most Third World countries have been dependent in part or full, on the Western Countries for development in science and technology. The growth and spread of ET in the Third World also followed the same path, i.e., influenced from without, leading to importation of both the concept as well as the technology itself. Also, as a subsystem of the wider economic system, educational services in the advanced countries were increasingly affected by private enterprise. Many of the innovations in methods of teaching for instance, would not have been possible without the large-scale manufacture and distribution of hardware and software. Thus it can be safely said that the growth and development of ET in the West was a cultural product and manifestation of the development and advancement of the economic-scientific-technological infrastructure.

It is against this backdrop that the development and meaning of ET in the Third World context assumes different dimensions to that of the developed countries. Whereas in the developed countries demand for ET stemmed from the growing educational aspirations of the population, from the requirement of a technological society for new and higher level skills and from the rapid rate of social and economic change with its requirement for flexibility of attitude, in Third World countries it is a prescriptive adoption of technologies that seem to offer a magic formula for overcoming educational backwardness and problems of educational development. Hence, the rationale for its importation, not only to take care of the rapid quantitative expansion of education but also the quality of such an expansion.

The meaning and importance of ET in Third World countries thus wavers between two interpretations:(a) the narrower one which sees ET merely as the mass collection and use of educational hardware and software; and (b) the wider one which sees it as the use of scientific knowledge for improving the teaching/learning process. Whereas the first is mainly concerned with equipment, the second embraces the selective use of media, personnel, knowledge, ideas and resources in the systematic planning, designing, production, management and evaluation of the educational process. It is important to emphasise here that machines and devices are just one aspect of ET and any conception of ET purely in technological terms is clearly inadequate. Such a conception would fail to capture the richness and complexity of ET, a field that draws from such diverse areas as psychology, sociology, economics, information science, system theory, etc., and whose application to ET has had very significant effects.

An excellent study done on the selection of appropriate instructional media in the Nigerian school system, showed that the Nigerian policy formulators and planners understood ET in its narrower meaning, which entailed the use of hardware and software such as the video cassette recorder, video camera and recording devices, projectors, television, computer-assisted learning devices, etc. Most of these were high technology instructional media in a developing country, mainly imported, or at best assembled in plants in Nigeria. The Nigerian case ideally represents the status of ET in Third World countries today.

The argument we would like to put forward here is that in the socio-economic and cultural context of Third World countries, preference and selection of high technology instructional media (HTIM) may not always be appropriate and may also at times be counter-productive to the very objectives it sets out to achieve. HTIM must necessarily be supplemented by low technology instructional media (LTIM) appropriate to the socio-economic conditions of Third World countries.

The tendency of Third World countries to show preference for HTIM, as demonstrated in the Nigerian case, may be attributed to (a) the instructional effectiveness of such media, (b) its innovative appeal, and (c) demonstration effect. The effectiveness of HTIM in enhancing the teaching/learning process is well documented. Their design and production incorporate important principles derived from studies of human perceptions and learning. In addition, they have been shown to be more cost-effective than traditional methods of instruction. Their innovative appeal lies in the fact that they are a part of the world communication revolution in which Third World countries wish to participate. Also, the experience of developing countries suggests that apart from cognitive gains, HTIM produce very positive, effective changes in learners through reduced truancy, increased pupil interest and activity and greater enthusiasm, that make the preference for such media all the more justifiable. However, there does exist a tendency of temptation in Third World countries towards imitating what is current practice in the advanced countries. Such an attitude is usually irrational and there have been a number of instances where schemes had to be suspended because of financial and infrastructural constraints.

Despite the greater instructional effectiveness and positive attitudes to learning, the questions that arose in the Nigerian case were: Should instructional effectiveness and increased effective gains be the sole determinants for choice of media? Is the present preference for these types of media in Third World countries justifiable? The author of the Nigerian study appropriately states that the criteria should be for selecting instructional media. These are:

(a) *Media attributes and suitability for a given learning situation:* Most HTIM possess specific attributes which make them particularly suitable for instructional purposes. For example, CAI (computer-assisted instruction) is more effective than traditional methods of instruction in terms of the pupil's academic gains and individualisation of instruction. Educational broadcasting, quite apart from creating new attitudes and enhancing children's participation, has been known to permit greater equality of opportunity than traditional schools. This suggests that given the vast array of media available, one needs to choose the one which best matches the learners and the task in terms of the optimisation of learning outcomes. Those media which do not match the learner and the task should thus be rejected. By this consideration, for instance, ETV, which combined synchronised sound, movement, mixing of images, high-speed and slow-motion photography, etc., should be chosen in preference to slides which do not have all these qualities, say in a lesson on blood circulation. Slides on the other hand would be more suitable for a lesson in, say, geography. Equally CAI, because of its suitability for individualised instruction, should be chosen in preference to traditional methods in the teaching of certain aspects of say mathematics. But considerations of media attributes have to be tempered with a consideration of other factors which make up the social reality of school systems in Third World countries.

(b) *Cost :* Costs should be an important consideration in the selection of instructional media. The cost of HTIM in most Third World countries is very high since they are, by and large, imported. Present financial constraints would rule out certain media, their attributes and effectiveness notwithstanding. The HTIM that would, for instance, fail the cost 'selection by rejection test' would include CAI devices, VCR, photocopying machines and filming equipment. Certain HTIM such as radio, tape recorder, 12" black-and-white television sets, slide projectors, and duplicating machines, whose prices are still reasonable, would pass the test.

(c) *Usability :* Most HTIM require the availability of repair and steady power for their smooth functioning. The well-known erratic nature of power supply in developing countries is only one factor that negates any effective use of such equipment. Acquiring certain sensitive electronic machines can give rise to often unforeseeable chain reactions, for instance, purchase of voltage stabilisers to avoid fluctuations, purchase of generators to ensure continuous power supply and sometimes the need for purchase of spare parts, etc. Even in situations where power supply is regular in urban areas, its non-availability in rural areas places children in schools there at a disadvantage.

(d) *Serviceability :* HTIM need storage facilities, and careful handling and maintenance. In general, Third World countries lack the appropriate storage facilities and personnel to service and maintain such equipments. The net result is that whenever breakdowns occur in such equipment, the equipment is either abandoned or let unserviced for two major reasons. The first is that necessary spares are often difficult to obtain and second, that when those are available, local technicians are usually unable to undertake repairs. Thus the availability of well-trained support staff is necessary for the successful implementation of most high technology-based instructional innovation.

(e) *Availability :* Most HTIM are imported and are usually expensive and difficult to find. In countries where local production of some of it has begun, they are not in easy reach of all due to high costs.

Thus, in spite of the great instructional effectiveness of HTIM, they are indeed expensive and difficult to maintain and service. Further, certain basic infrastructures for their smooth functioning are at present not adequately available. Reasonable media selection must not only reflect a consideration of media attributes and effectiveness but must also reflect a consideration of the socio-economic realities in which the media are going to be used. This should however not be seen as a blanket rejection of HTIM. Media recommendation and selection should be guided by a philosophy which seeks to reconcile the theoretically desirable with the practically possible.

Low Technology Instructional Media

Given the unsuitability of certain HTIM, the Nigerain study suggests that educators and curriculum planners actively encourage the development and use of Low Technology Instructional Media (LTIM) as supplementary to those HTIM that are justifiable and practicable. LTIM would imply production and utilisation of inexpensive but durable educational material which are produced locally with local materials by indigenous crafts people. This would include programmed texts, mobiles, and still pictures. The skills and talents of photographers, painters, carpenters, electricians, mechanics, cartographers and printers could be effectively harnessed. In order to improve on their skills, it may be necessary for them to attend short courses in the designing and production of low technology media, polytechnic, universities and educational technology centres would have vital roles to play in these training programmes. The objective here would be the flexible, creative combination of available HTIM and locally made LTIM to optimise the instructional process. Media selection should be guided by pedagogical, economic and media effective consideration.

Future of ET in Third World Countries : Management Implication

The object of technology must be to improve the lives of people by increasing their capacities over themselves and their environment. The implementation of these changed capacities will cause many unexpected side effects, which can be undesirable and painful. Neither the costs nor the benefits of technology are necessarily spread evenly. We must, therefore, always take good care to think through the implications of change to minimise costs and hardships involved, and thereby minimise resistance in improvement. Because technology involves concentration of people's highest abilities on a particular field of activity, it is necessary to ensure that the vanguard maintains its lines of communication with its base. Specialisation is vitally necessary, but it has its dangers that one should be alert about.

To the extent that educational technology succeeds, it enables us to teach more quickly, more effectively and more cheaply, with given resources. However reaping the fruits of technology is not quickly, easily or simply done. Its full and proper implementation will not only require effort, time and money, but also massive upgrading of skills involved in our schools and colleges. Careful assessment of its cost-effectiveness will undoubtedly be necessary. If educational technology succeeds, a given amount of resources—teachers, pupils, buildings will yield greater value in terms of education.

In ET, there is the need for a more concentrated approach to the basic science of human learning leading to a better understanding of the individual learning process the way it varies from one person to another, and hence enabling us to identify the appropriate mode of learning for the individual and of methods to match. Finally, of course, the effective science of human learning offers us the possibility of a major improvement in the effectiveness of education. The advanced countries have been successful to a considerable extent in developing systematically, theories of human learning. We, in the Third World, have yet to develop our own cognitive frameworks in this science which would be socio-culturally specific. This is one of the most important tasks for Third World countries in the development of ET.

Secondly, depending on the development strategy of a country, technologies could be selected or rejected according to their 'appropriateness' to chosen goals and priorities, e.g., a country that assigns high priority to rural transformation may find radio less expensive and a more practical medium, able to reach isolated populations without electricity. Apart from electronic media, an interested country such as India, to bring awareness to the rural masses, could utilise a broad range of means such as mobile teams of educators and expansionists, popular travelling cultural troupes, inexpensive print material and resident community organisers and learning facilitators.

Management of ET would then involve establishing of community learning centres where individuals of any age could take short courses, receive counselling, share interests, teach skills, obtain learning materials, participate in community activities, receive health and nutritional care and gain access to information on national welfare services like radio and television.

The basic thrust here would be a movement towards decentralised control over the media and local participation in planning programmes reflecting the needs and interests of the diverse populations comprising most Third World societies, and enhancing the self-awareness and self-expression of both individuals and their communities.

The danger with technology (educational technology not excluded) lies in the fact that it very soon takes control of people, their lives and priorities. The success of management of ET would therefore lie in letting individuals exercise direct control over technology in structuring their various social environments, thereby developing and understanding their needs through their exercise of power. The educational technologist thus has to be aware of not only the negative socio-political and cultural aspects of ET but also its emancipatory potential.

Works Cited

Ministry of Human Resource Development, *National Policy on Education - 1986*, Government of India, Department of Education, New Delhi.

——*Programme of Action*, Government of India, Department of Education, New Delhi, 1986.

J. Robinson and N. Varnes, (eds.), *New Media and Methods in Industrial Training*, BBC, London, 1986.

Elton, L.R.B., "Educational Technology - Today and Tomorrow", in *The Spread of Educational Technology* by P. Hills and J. Gilbert (Eds.), *Aspects of Educational Technology*, Vol. XI, Kogan Page, London.

Habbard, G., "Conditions for Progress - An Analysis of Educational Technology", in *Aspects of Educational Technology*, Vol. IV, Bajpai, A.C. and Leedhan, J.F. (eds.), Pitman Publishing, Bath, 1970.

Skinner, B.F., *The Technology of Teaching*, Appleton-Century-Crofts, 1968.

This is associated with Carl Rogers, *Encounter Groups*, Penguin · Harmondsworth, 1969 and Jane Abercrombie, *The Anatomy of Judgement*, Penguin, Harmondsworth, 1969.

Percival, F., and Ellington, H., *A Handbook of Educational Technology*, Kogan Page, London, 1984.

Bolam, R., "The Management of Educational Change", in Y. Houghton, R. McHugh and C. Morgan (eds.), *Management in Education*, Ward Lack Educational, London, 1975.

Gibbs, G., *Teaching Students to Learn : A Student Centred Approach*, Open University Press, Milton Keyness, 1981.

Saettler, P., "The Roots of Educational Technology", *Programmed Learning and Educational Technology*, Vol. 15, 1978.

Tyler, R.W., "Utilisation of Technological Media, Devices and Systems in the Schools" *Educational Technology*, Vol. 20th, No.1, 1980.

Ibebuzor, N.A., "Appropriate Instructional Media Selection (AIMS): An Issue in Educational Technology in the Nigerian School System"; *British Journal of Educational Technology*, Vol. 17, No. 2, 1986.

Robert F. Arnove, "Socio-political Implications of Educational Television", in R.F. Arnove (ed.). *Educational Television: A Policy Critique and Guide for Developing Countries*, Peraeger Publishers, New York, 1976, p. 19.

4

TECHNOLOGY IN EDUCATION OF THE VISUALLY DISABLED

M.N.G. Mani

The National Educational Policy of the Government of India emphasised on modernisation of education. Steps are being taken in introducing the latest technology in the field of education. Special Education, being a part of the general education, will also have this evolution in a gradual manner. The tremendous application of the technology has already been realised in the life of the disabled individuals; yet it needs to be viewed qualitatively and quantitatively in universalising the educational opportunities to them.

The technological growth in the education of the disabled has two-fold objectives, both are equally important:

1. Technology that reduces the handicapping conditions.
2. Technology in the learning of the disabled child.

While the former deals with the invention of hardware technology, the latter pertains to both the hardware and software technologies.

Technology to Reduce Handicapping Conditions

It is clearly evident from researches that a considerable percentage of visually disabled children who are classified as 'low vision' and 'partially sighted' could be benefited by optical aids which are suitable for their individual conditions. Proper intervention is necessary to detect such children who could be benefited by such aids. In a similar manner, the invention of electronic aids for mobility, such as the pathfinders, sonic guides etc., are using the calculator and the like as sources for a visually disabled person not to depend fully on the sighted for activities like arithmetic. Some of such aids which reduce the handicapping conditions of the visually disabled individual are as follows:

Collapsible Cane

This cane is made of a special grade of aluminium tubing which can be directly formed into conical numbers. This technique, called swaging, requires a very special machine, a swaging machine.

Taccom

Taccom is a cigarette-package-size device that can be carried around in a persons pocket. It is essentially a radio receiver that, stimulated by a signal from a small transmitter at the point under 'surveillance', produces vibrations and thereby provides an adequate tactile warning to the individual. This equipment is mostly used by the deaf-blind person.

Sonic guide

This device contains ultrasonic sensors mounted on a pair of glasses, with ear moulds to obtain signals reflected from objects within its field. Differences in sound provide the wearer with information on distance, direction, and surface characteristics of the object (e.g., a tree would not sound the same as a concrete wall.

Bliss Passive Detector

Converts optical images into vibrations or sound signals; used like a flashlight.

The Path Sounder

This is used in conjunction with a cane and reaches ahead of the blind traveller several steps beyond the reach of the cane to provide information about possible obstacles.

Laser Cane

The laser cane is essentially the familiar long cane into which is built three gallium arsenide lasers and three photocells. The lasers are small crystal devices which project a beam of reddish light within a very narrow frequency band in the visible spectrum.

Optacon

Optacon is about the size of a dictionary, weighs eight pounds, and operates on batteries. The probe, which is about the size of the lopstic case, performs much like a television camera, except that instead of handling images of 250,000 points it handles images of only 144 points. The probe has a little window through which it can "see" an area about the size of one letter. The image received through the probe is then magnified and displayed on an array, or mosaic, of 144 tactile pins. The activation of these pins produces a vibratory image of the letter from the page on about half the area of the finger. The probe is moved across the line of print, left to right, each letter being recognised through the moving vibratory image on the tactile display.

Talking Calculators

The invention of talking calculators is a big breakthrough in the education of the visually disabled. However, the cost factor is a major detriment to its usability by many visually disabled people. Therefore, if this development is to reach many, the cost should be minimised. Local expertise can be encouraged to make prototypes of this equipment.

Technology in Learning

The technological involvement in the education of the visually disabled is rather inevitable. The progressive view towards this has emerged in recent years. The scientific and technological developments have made wonders and will be continuing to make the 'impossible today', a 'possible tomorrow'. This world has come to the stage in such a way that life is meaningless without the links with technology. Introduction of the computers and the television to education is a result of this trend. Like general education, special education also has witnessed a phenomenal expansion of technology in enhancing the learning of the visually disabled individual. Production of braille material, has been completely mechanised in such a way that the visually disabled can interact with the machine and get his work done; a low vision child can have his choice of lighting condition for his learning and so on. Some of the important innovations in the learning of the visually disabled child are as follows:

Braille Master

This is a machine which does automatic braille translation systems to translate braille to normal letters and vice versa. This is a typical example for the advancement of electronic engineering. It allows both the visually disabled and sighted persons to operate as it contains the keyboards of both the normal typewriter and a mechanical brailler.

Computer-Assisted Production of Braille

The computer is being used in a batch process system or in an interactive system. In the batch system the input is a long stream of controlling commands. The computer then does its work uninterruptedly and the output is a continuous stream of braille. In the interactive system, a person types in a question to the computer and the computer answers in braille.

Relief Copy Machine

This machine instantly produces copies of writing both in print and in handwriting in relief to the required number. This machine consists of a dry-type standard copying machine and a foaming unit. Lines, dots, figures, illustrations, graphs, maps, patterns, letters and photographs are first copied on relief copy paper. The forming unit then applies thermal treatment so that dark parts will emerge in relief. It will require about 10 seconds to produce a relief copy.

Closed Circuit Television System

The closed circuit television system is used for the education of low vision children. This system includes an inexpensive television camera (like those used in banks and hotels for surveillance) which is focussed on the reading material. The enlarged image of the letters then appear on an ordinary television set or monitor. The control of the movement of the camera and the magnification, intensity, and contrast of the image are under the control of the reader.

Harmonic Compressor

This device makes it possible to double the word rate of recorded speech while preserving vocal pitch and quality.

Aural Reading Machine

This will allow the individual who reads by listening to search the desired information by scanning.

The next stage in dealing with this is the discussion of the relevancy of the technological application to the present condition of the education of the visually disabled.

Relevancy in Indian Context

The relevancy of the above technological developments to the education of the visually disabled is to be viewed objectively in India. Even though the technological developments have been very much recognised and the results were achieved towards the independence of visually disabled people in the developed countries, India has to wait for a long time to knock at the doors of this high technology. Various reasons may be cited for this developmental lag:

1. The present status of special education is at the crossroads. The quality of education of the visually disabled is in question in the midst of educators, social workers and administrators. It has not achieved its basic objectives of providing socialisation and mainstreaming activities.
2. What needs to be looked immediately at this juncture is the provision of effective software approaches to raise the status of education of the visually disabled who are unable to study some important academic subjects due to the lack of appropriate software.
3. Unfortunately, human resources are not channelised to give a real meaning to education. Moreover, special education has not attracted resourceful manpower for its development.

The introduction of technological developments to the education of the visually disabled should also be viewed in terms of accountability and utility. In introducing the latest innovations in the schools, the following issues are to be addressed by the government or the voluntary bodies.

1. Providing Basic Amenities

While general education is said to have not developed basic amenities for education of the children, special education, which is a part of the regular education, too, has failed to provide the basic amenities to the children. It is a paradox that the special needs for visually disabled children are felt and at the same time, we are not able to provide the special facilities to them. When the visually disabled child has no basic material such as a braille text and a slate for his day-to-day functioning in the school, introduction of the computers and television would be a very difficult process.

2. Increasing Resources

Unfortunately, India has the largest percentage of visually disabled population of the world due to various reasons. The budget provision for the education of the visually disabled is considerably a very less quantity which can reach only a very small percentage of population. Therefore, resources should be explored for providing maximum benefits to the schools and to the education of the children. Technology insists mostly on individualised instruction to the disabled child and the question to be answered is how much expense the organisation would have to incur for such cases. Undoubtedly the present expenditure on education of the visually disabled should be provided in multiple times to the introduction of the technological developments in the schools. With limited resources, it would be difficult to think of optacons and braille masters.

3. Universalisation of Education

The universalisation principle, without taking into account this disabled population, is not a reality. While efforts are being made to reach maximum visually disabled children by mainstreaming principles, the introduction of hardwares without the increase in the budget will further restrict the number of beneficiaries. It is to be assessed whether technology development can achieve universalisation, too.

Expertise

It is a universal fact that introduction of new innovations had left the teachers in panic in the past and the trend is continuing. It can also be seen that teachers are reluctant to some extent to the change of approach and to accept new innovations easily. Unless the teachers are oriented to the latest trends, provision of hardware machines to the schools will be of no use.

Accountability

The accountability in special education is the fear of teachers and administrators. The first element of a programme of accountability is for schools to state what their objectives are and to have their success judged by how well they reach those goals. It is based on the delivery of both the hardware and software technology. In these circumstances, how far will the technology be used to the maximum extent in providing educational services to the disabled? In special education, the educators have been affected in the past by accountability, they will be in the future also.

a. Is the technology going to help more students?
b. Is it going to raise the status of education of the visually disabled?
c. What would be the initial investment?
d. What are our goals in using hardware technology?
e. What is the evaluation criteria?

Unless clear analysis is made on the basis of empirical data for the above issues, the accountability to special education cannot be realised. It should demonstrate to the reviewers the student accomplishment promised for the expenditure of resources.

Plan of the Immediate Future

The world is fascinated by technology. For sound technological growth in the education of the visually disabled, the following measures are necessary for laying a strong foundation:

1. Upgrading the Teacher Training Programmes

On the one hand, special education insists a lot on the skills of the teacher; on the other hand, a certified teacher of questionable competency is likely to be hired as a special education teacher whereas he would not be hired as a regular class teacher. It is a clear indication that special education in the past has relied on sympathy and did not have a professional approach to the work. If professionalism is to enter special education, training programmes of teacher educators have to be organised. The lack of manpower, which is clearly seen in developing countries for special education, may be quoted as the reason for its dissatisfactory functioning. Advanced training courses have to be designed for strengthening the necessary manpower for special education.

2.Establishing Braille Presses

The number of braille presses functioning in India are not able to cater to the needs of visually disabled children. Moreover, the braille presses are located region-wise, each has to look after two or three languages of the states in the region, which is reported as a cumbersome task for the press. The immediate goal may be the establishment of braille presses, at least one for each state. This can deliver the services to the needy blind people efficiently. Materials play a predominant role in the improvement of special education. Without this fundamental need, mere technology will not suffice the purpose. It is meaningless at this stage to plan for computer-assisted braille.

3. Orientation on Software Technology

Massive programmes are essential for orienting the teachers and other personnel on software technology. Methods of teaching, use of equipments etc., have to be oriented to the teachers. For example, the majority of the teachers are not aware of the mathematical device and the mathematical codes—that is why some states in India are denying subjects like mathematics and science for visually disabled children. Thus, it is not the difficulty of the visually disabled children in learning such subjects but the deficiency in teachers in handling the situation. In these circumstances, learning of computers, and other techniques would be a tough task for any teacher. A legislation is necessary, requiring that all the existing teachers have in-service programmes in software technology to update their professional knowledge.

Promotion of Local Technology

India has advanced to a great extent in the invention of aids and equipments for the education of the visually disabled. The latest invention of the Taj Brailler by Voltas and the Indu Therm and Indu Brailler by the IIT Delhi, are significant contributions to local expertise in the field of education of the visually disabled. Due to the enormous cost of imported braille typewriters, the visually disabled children did not have any hope of having braille typewriters of their own. But today, the local brailler, which costs less than half the price of the imported brailler, is a great hope to visually disabled children. Similarly, the cost of the duplicating sheet has come down to fifty per cent of the price of the imported brailon sheet. In spite of these inventions, there is a tendency to go for imported equipment from abroad. A legislation is also necessary for insisting that the organisations should procure the locally available equipments for the education of the visually disabled. This will avoid unnecessary delay in getting equipments and also promote national efforts for this.

5. Education for All

This is a dream everyone has and it would really be a miracle to achieve this in another decade. Every state can make an earnest effort to realise this. If it is not totally possible, at least a large group can be benefited by the efforts. Introduction of integrated education programmes on a large scale may be the only answer for achieving this universalisation. Two kinds of opinions are existing worldwide in this mainstreaming principle. One is to place a visually disabled child in a regular school after necessary preparation in a segregated school. The other approach is the placement of visually disabled in the regular schools as early as possible. Both the approaches have valid reasons. Again, the cost factor will be an obstacle to the first type as the country will need more segregated schools then. This will further delay the possibility of service to many children. The only possibility is the integration principle of the second kind. While emphasising this principle, the existing residential schools may be made the Centres for Education of multiple-impaired children, which is a field widely neglected in most of the developing countries. The expertise of the existing special schools can be tuned to the education of multiple-impaired children. This may look ideal but it needs enormous energy and stupendous efforts to accomplish.

Transition from traditional to new pattern of technology is the symbol of growth. This can be viewed in two dimensions:

1. Transition from traditional to new patterns of programming.
2. Transition from traditional to new patterns of equipment.

While the former needs a lot of software technology, the latter needs a lot of hardware technology. As we are not ready for the latter, the former approach is the viable one for the present to universalise educational opportunities for disabled children. While doing so, hardware technology will find its place.

The revolution of technology in special education is definite, but not for the present.

Let us go for Universalisation!

5

PEDAGOGY OF TRIBES

K. Sujatha

Introduction

In India the educational policy makers and planners usually have impressionistic points of view regarding the educational problems of tribes and financial assistance. Subsidies, provision of facilities are considered enough to increase the educability of tribes. In fact the limited efforts have resulted in marginal success. Though there are sporadic discussions on the relevance of content and curriculum to tribal life and culture, hardly ever talked about are the indigenous learning pattern, pedagogy of cultural transmission among tribes which can be useful to modern educational perspectives. This paper basically tries to explain how traditional tribal pedagogy can be adopted to formal education particularly for instructional designing and communication of knowledge. This paper also examines how far modern media and other aids can be useful in educating the tribals. The body of the paper contains four sections. The first part gives a brief introduction to the tribes and their educational problems followed by a detailed discussion on traditional pedagogy. The third section deals with the inter-relation of a tribal learning pattern in the context of the modern perspective. The last part examines the relevance of media and educational technology aids for improving the teaching-learning process amongst tribals.

Tribes and their Educational Problems

India has the second largest tribal population in the world i.e. 8 per cent of the total population of the country. There are 450 tribal groups listed and they speak different dialects mostly without scripts and belong to different racial groups each with a distinct socio-cultural and economic life. In spite of conscious efforts to bring them in to the fold of formal education, they are far behind. However, there are exceptions where tribals are much ahead in their educational progress, (e.g.: in north eastern region of the country) but as these are isolated instances they are insignificant in terms of quantity and quality.

In order to fulfil the constitutional obligations the governments both at state and central levels introduced special measures for the educational development of tribes. However facilities and incentives provided for their education made very limited progress. The educational progress is not only slow but varies across the states and different tribal groups. The progress of education among the tribes is very slow, due to low participation and alarming dropout rate and failures. The reasons for the same have been studied by empirical research using questionnaires and production of voluminous data for quantitative support. Many studies came to the conclusion that 'Poverty' is the main reason for their non-participation, however, some studies pointed out that the present content and curriculum and pedagogy are not in consonance with their life and culture. But here the contention is that poverty is an inpediment, but why do even those who decide to attend the school soon find it difficult to cope with the system and this results in failure and dropout. Without denying the validity of theories that underline the economic and social constraints that affect the educational development, and without denying the evidence available from quantitative surveys, it is essential to understand the constraints of the internal process of the school system. In other words, one can classify educational constraints into three sets i.e. external, internal and psychological. The external constraints relate to socio-economic aspects (which are usually taken note of), the internal constraints are those that arise within the school system i.e. content and curriculum, teacher and pedagogy, the precise teaching-learning process.

The psychological problems are attitude, motivation, cultural conflict, mutual adjustment , etc., which are common to first generation learners. If we examine the governmental efforts for the past forty years for educating tribals, we find that all the measures are directed towards external constraints. The provision of education along with incentives and different facilities reflects that the government is trying its best to help the tribes to reduce the influence of economic deprivation on education of the child. But equally important is the quality of inputs and an appropriate approach to educational development of tribes. The effectiveness of the school system has substantial influence to win over the confidence of both parents and learners. Unless there is appropriate and qualitative teaching neither do the students show any positive performance nor are the parents inclined to educate their children. As such there is low enrolment among tribes and even those who join the school dropout within the first two to three years.

Besides poverty, another important reason is lack of interest among students and parents (Sujatha 1988). Children are not interested in education due to alien medium of instruction and strange content and pedagogy.

When parents feel that their children are not benefiting immediately from their education, they prefer to put them into a family business/household work. Otherwise they will be losers in both worlds. Therefore, it is not always true that tribal children attend the school just because of facilities and incentives, in which case, tribal parents might have sent their children to Ashram Schools knowing that the children would at least receive food and clothes. But the situation in these schools is as bad as in others with meagre enrolment and significant dropouts.

However, provision of facilities like school and hostel and economic support is essential but they are not sufficient for participation and effective learning in the school.

Traditional Pedagogy

Though relevant content and curriculum is an important aspect for the successful spread of education among tribes, one cannot expect a separate or different curriculum, but it can certainly be modified to meet the socio-economic needs of local communities. In fact there can be two views about what type of content and curriculum should be prescribed in tribal schools but there cannot be two opinions about "what type of teacher and what type of teaching methodology" should be provided. Thus the teacher and pedagogy would play a vital role for accelerating educational progress among tribes. The instruction offered in institutions of elementary, secondary and higher education broadly follows the pattern in vogue in non-tribal areas, without any serious attempt to link it to tribal life and its needs. For a larger number of dropouts the educational experience of two, three or even four years is a meaningless exercise. It does not equip them to function effectively in any area of life. The pedagogic tools used are generally those evolved in the urban areas. The low level of performance of tribal students should be attributed not to their innate mental deficiency but to uninnovative and unimaginative pedagogy. Primitive communities for centuries not only maintained the distinct culture but have an understanding of their immediate environment. In fact continuity of culture without tension needs appropriate methods of transmission of knowledge, and skills etc., which is evident among tribes.

Most of the tribal societies depend on oral culture for transmitting knowledge and skills which entail a set of powerful and effective mental strategies. Some of which, to our detriment have become attenuated and undervalue many aspects of our educational systems. Though the aim of formal education is not preserving and encouraging oral strategies, indeed, we see fast developing around us features of what Cong (1982) has called "secondary orality" for which the electronic media is its most powerful promoter. Although the oral method of learning is not the end of our educational method, it is highly useful and it is worthwhile to see how oral culture can also be used as a supplement for effective learning. A tribal youth in an oral culture needs to spend considerable mental resources to learn by listening. Proverbs and maxims and riddles uttered at meals, on rising or going to sleep, in the market or the field, have necessary educational messages about their immediate environment, interpersonal relationship and occupational practices. However, learning in the sustaining messages of an oral culture differs from the effort of accumulation of knowledge in formal education. In formal education, verbatim repetition is the objective; while in oral culture, it is to understand, remember and act upon. In fact, the realisation of the value of traditional teaching and learning activities organised freely in natural environment to make a basis for improving and broadening current educational theories and for bridging the gap between formal and non-formal education has already begun in western societies which started to discover the learning pattern in some African Societies (Milton, 1985). Further, the knowledge about the areas of correspondence between formal and traditional learning can facilitate technical assistance and cross-cultural transfers if used as guidelines for the selection of the most appropriate technologies and instructional strategies.

Tribal Learning Pattern and Educational Technology

The first similarity between traditional and formal learning occurs quite appropriately at the level of educational objectives or, more precisely, with the concern for stating them in clear behavioural terms. Interest among Indian educators in behavioural objectives can be traced to ancient times but in course of time the objectives have undergone changes. The important aspect is that the learning objectives be expressed in a manner that informs the learner of exactly what he will be expected 'to do' after a learning experience in order to demonstrate mastery.

Gagne and Briggs (1974) have elaborated upon this principle with advances in the related areas of learning theory, task analysis and the sequencing of instruction (Gagne and Fleishman, 1959, Gagne, 1962, 1965, 1970 Briggs, 1968, 1970,77). Their works are considered landmarks in modern instructional design and their models have found wide application at all levels of formal education. On the other hand, behavioural objectives are also of paramount concern in tribal traditional pedagogy. Much of the community-based education which the child receives is concerned with mastering an ensemble of prescriptive bahavioural codes which provides guidelines for managing most of life's contingencies (Admas, 1983).

While standards of proper social conduct and vocational techniques might vary from one tribal culture to another, almost universally the content of the curricula is concerned with teaching the child 'how to do' and 'how to be'. There is hardly ever any confusion over what behaviour is expected from the individual and what behaviour must be demonstrated for advancement in the society. In view of such convergence between these two approaches, it would seem reasonable to expect that a comprehensive learning programme driven by the assumption that 80 per cent of the learners are capable of mastering 80 per cent of the learning objectives would be more consistent with the traditional tribal assumptions about education. This may be more greatly appreciated by the students. For preparing instructional designs one needs to understand the underlying principles of tribal learning in their folk songs, folk tales, ballads etc. These principles can be put into the framework of current educational research findings and educational practices. In this, one has to examine the compatibility of strategies. Some of the cultural accounts of tribes show that an essential component of the pedagogy would be to instruct tribal children through group activity encouraging participation of every single student (Dube,1982). Workshops and skill sessions would be more important and effective methods of instruction than conventional classroom teaching emphasising rote learning. Conventional classroom instruction, thus, will have to be supplemented with group activity as well as other methods of participative learning. While emphasising participative learning, it would be worthwhile giving an example of how a herbalist is trained in tribal society.

To begin with, the herbalist first understands the personality traits of his trainee and the learning process is informal and follows no set curriculum. The student understands each disease and the cures as the cases arise. Apprenticeship normally begins by accompanying the herbalist to the bushes and forest to fetch the required herbs; gradually they progress to the point where they actually fetch the herbs themselves, especially if these are roots which must be dug up. Mixing different herbs and preparation of concoctions for different diseases is again a long procedure which requires close observation and keen interest. Effective learning depends on two things. One is how much time the student devotes and how many cases of various diseases arise for observation and learning. During the training, identification of different herbs and their functions is more important. This is taught through practical apprenticeship. While sorting different herbs and roots, the herbalist asks the student to taste and smell each bit to differentiate by smell and taste so that mistakes can be avoided in identification. Whenever a patient visits the herbalist he asks his students to bring a particular herb or root which gives an opportunity to identify them independently. Once the student advances in his learning, he becomes an assistant with an opportunity to deal independently.

Thus, herbalist training in a tribe involves four basic processes — observation, identification, collection, and participation, thus four pedagogical principles. Learning by observing, by participating, by initiating and by doing. But education does not stop at merely learning about herbs and diseases. The individual discovers different combinations of herbs, their proportions etc. (Sujatha 1988). Another important inter-related dimension of instruction in traditional learning and teaching is obedience and loyalty on the part of students, reward and motivation by the instructor manifested in different forms of interpersonal relationship.

The foregone discussion would indicate that the traditional learning patterns in tribal societies are based on sound education principles. It is, hence, important to give attention, and serious thought on how traditional padagogy can be suitably adopted into modern learning, if not for all, at least for tribal children. It is not the intention to prove either that the tribal child can learn only through its learning method, or that modern methods should be introduced. Instead all efforts are to see how effective instructional designs can be developed for those who are culturally different. In fact in the absence of this type of exercise, most of the time the teachers have pre-conceived notions about mental abilities of tribal children and have low performance expectations by labelling them dullards. But some empirical evidences show that there is a relationship between such expectations, labelling and failures (Leacock, 1971). The central finding of Leacock's study was that academic expectations of teachers based on social, class origin and race of the children were crucial for the students' learning process. Many of the teachers not only seemed to attribute tribal pupils' learning difficulties to their respective home backgrounds or mental deficiencies as they called them, but also believed there was nothing they could do about these difficulties interpreted by them in sophisticated, escapist terms as of 'lack of interest' among students and parents for schooling (Ambasth 1968, Ratnaiah 1978, Sitatoppo, 1982, Sujatha K. 1987, Sachidanda 1967). The conventional teacher training programme prepares its students to teach among similar cultures. As such the teachers lack flexibility in thinking due to lack of proper orientation. They have only a few pedagogical tools with which to teach and measure the outcome. Such activity might not be related to the world lived in by the child, as is evident from the following example: It would appear that teachers feel more confident in teaching the way they were taught rather than adopting a more practical approach.

The teaching technology at formal schools instead of resocialising the tribal child attempts to desocialise and confuse the child ultimately affecting his pace of learning. As the child comes with cultural and behavioural norms learnt from parents, peers and kinsmen, we need to modernise the traditional learning pattern appropriately to suit the child. Such a child will learn quicker from practical experience rather than theoretical explanations and suitable teaching aids should be employed in order to create a more meaningful learning situation. The tribal art,and motifs which depict their life, religion and ecology are excellent for making the child understand its culture in the proper perspective. Does the school system even try using more visual aids (maps, charts) to explain different aspects of the curriculum?

Another common problem in tribal education is that the medium of instruction is a regional and national language which this little child has neither learned at home nor in the community. The teachers working in tribal areas, most of whom are non-tribals, have no knowledge of tribal dialects. In this situation how can either teaching or learning be effective? However, many of the third world countries too have this problem, and some of them have successfully overcome it by introducing appropriate educational technology both modular and non-modular media to supplement the classroom teaching and to provide in-service training to teachers working in those areas.

Media and Education of Tribes

It is difficult to suggest any prescribed educational technology for all the tribes as they differ substantially among themselves and are at various levels of development. In different levels or classes different educational technologies would be effective. While in the preparatory and nursery classes, simple but related audio-visual aids and community methods may explain better and socialise the child, in the higher classes, the instructional design needs to be based on both scientific principles and learner orientation. It is essential to examine how far broadcast media and modular media can be effective in teaching.

The recent experiment of modular media (video education) introduced in rural primary schools in Andhra Pradesh for enriching the classroom teaching for tribal children with more relevant and societal based pedagogy has proved encouraging. The child is able to relate to the visuals as they depict scenes with which he is acquainted.

Kinyanjri (1977) contends that radio is an especially powerful medium for education in 'verbal societies' such as tribal societies where 'oral' traditions are still strong. Perhaps the extension of radios would deepen or rekindle these important oral traditions and affect the abstract mode of thinking.

With regard to the effectiveness of radio in teaching languages the existing evidence does suggest that radio can be uniquely effective in the teaching of the language.But teachers need to be alert to the learners' attention spans and to the apparent need for active involvement on the part of learners. Interest limits and active physical responding seem as relevant to instruction in language as in mathematics (Searle, 1977). Thus the units of language instruction need to be vividly imagined and can be built upon and integrated.

In Nicaragua, the radio has been used in a large number of schools, for the purpose of teaching mathematics only. In a USAID - sponsored project the primary school mathematics syllabus was revised and the radio was adopted as the teaching medium. The use of print with radio has not only made it more convenient for teachers to use the radio, it has also contributed to a shift in its function as it started as teacher support and classroom enrichment.

Dictation or transcription can enrich the learners' listening and production skills in a new language. Thus, the radio is an excellent medium of instruction both for learning a language and in the development of listening skills.

Radio could play the pivotal role in the construction of bridges from mother tongue instruction to that in widely used indigenous languages (Lamber and Sidoti, 1981).

Many recent technical developments are both reducing costs and increasing the capabilities of teaching, to deal with educational challenges and problems. In short, educational television is on the threshold of becoming an important instructional media as the National Policy on Education strongly recommends supply of TV sets to schools in a phased manner. The television cannot only be used for enriching the students learning but it can become an effective tool to improve the curriculum and instructional design by teachers. It can show better and more innovative ways of teaching. TV has invaluable importance to improve lesson plans and instructional methods.

To put media's educational uses into future perspective, it is necessary to consider the three important functions of teachers.First they present the information, then, they observe, receive, acknowledge and diagnose the learners responses and progress, and then evaluate them in relation to the educational goals. Finally they have to present cognitive and affective feedback to learners by assessing the learners' response and instructing them on what they should do. In all these teachers activities the medium functions as a mediator. For example, TV can show what a teacher wants to emphasise more precisely than a gesture or the voice can. Devices like maps, charts, models, puppets can help the teacher to present the information in a precise and cohesive manner thus facilitating comprehension. Information software like slides, flimstrips would help the teacher in his presentation and hold the attention of the learners.

One can provide all kinds of media-materials for education of tribals, but there can be no impact unless both teacher and learner are prepared to use it appropriately. Using equipments/aids requires not only interest among teachers but also they need to know 'how and where' the aids can be most effective.

However, there are many constraints to be overcome before the introduction of the various media in teaching. Most of the schools neither have adequate teachers, nor simple teaching aids or regular supply of required materials. However, the new thrusts on educational technology mentioned in National Policy on Education (1986) and followed actions and schemes which have already been initiated provide for the supply of a cassette record player and other low cost teaching aids under the 'Operation Blackboard' scheme. Similarly, the supply of televisions to all schools in a phased manner has already begun. Therefore the schools in tribal areas would also acquire the technological aids sooner or later. Based on the evidence regarding under or non-utilisation of the aids, lack of motivation and interest among teachers to use media and aids for enriching the teaching and learning process, there is an urgent need to develop proper planning and management of educational technology at various levels in order to optimise its effectiveness. Teachers as well as the tribal community need proper orientation about the scope and functions of media.

There is plenty of scope for improving the educational system in tribal areas. Formal education can strengthen the present teaching methods for tribal children. Besides revision of the technology of teaching, teaching aids and media would be employed to improve both teacher competency in tribal areas and childrens learning. However an important dimension is how and what media should be selected and their proper management will help in achieving the objectives of educational technology in the context of tribal education.

Works Cited

Ambasht, N.K. *A Critical Study* of *Tribal Education with Special Reference to Ranchi District*, New Delhi, S. Chand & Co, 1970.

Adams, M, "Behavioural objectives, processes and outcomes in Traditional Education", *Presencafricance* No. 125, 1983.

Briggs, L.S. *Sequencing Instruction in Relation to Hierarchies of Competence* Pittsburgh, American Institute of Research, 1968.

Briggs,L.S., *An Overview of Instructional System Design*, Jallahahassee, Florida State University, 1970.

———, *Instructional Design : Principles and Applications*, Englewood Cliffs, N.J. Educational Technology Publications, 1977.

Dube, S.C., "Cultural Dimension of Tribal Development" in Bhupinder Singh (ed.) *Steps Towards Tribal Development*. The Third Step, New Delhi. Government of India, 1982.

Gagne, R.M. (ed) *Psychological Principles of Systems. Development*, New York, Holt Rinehart & Winston, 1962.

———, The Analysis of Instructional Objectives for the Design of Instruction in: R.Glaser (ed) *Teaching Machines and Programmed Learning*, II, Washington DC, National Educational Association of the United States, 1965.

Gagne, R.M., *The Conditions of Learning*, New York, Holt Rinehart and Winston, 1970.

——— and Fleishman, E.A., *Psychology and Human Performance*, New York, Holt Rinehart & Winston. 1959.

——— and Briggs. L.J., *Principles of Instructional Design*, New York, Holt, Rinehart & Winston, 1974.

Kinyanjri, P.E "In-Service Training of Teachers through Radio and Correspondence in Kenya" Edited by P.L.Spain, D.T.Jamison and E.G.Anany, Washington, D.C. World Bank Staff working paper No. 266, 1977.

Lamber W. and Nelly Sidoti, Choosing Instructional Language for Education Radio Broadcasts in Less Developed Countries in *The Educational Use of Mass Media* Prepared by Gloria Feliciano and others, Washington D.C.World Bank Staff working paper No. 491, 1981.

Leacock, C. Theoretical and Methodological Problems in the study of school in Wax, M.L., Diamond, S., Gearing, F.O, ed.

Anthropological Perspectives on Education, Basic Books Inc New York N Y, USA, 1971.

Milton N.Adams and Medjomocoulibaly, African Traditional Learning in Modern Perspective, *Prospectus*, Vol XV. No. 2, 1985.

Ratnaiah, E.V, *Structural Constraints of Tribal Education*, New Delhi, Sterling Publishers, 1978.

Sachchidananda, Socio-Economic Aspects of Tribal Education in Report of National Seminar on Tribal Education, New Delhi, NCERT, 1967.

Searle, B.P., Suppes and J.Friend.The Nicaragua Radio Mathematics Project. *Radio For Education and Development. Case Studies,* Edited by Peter Spain and others, Washington, D.C. World Bank Staff working paper No.266, Wolt, 1977.

Sujatha K. *Education of the Forgotten Children of the Forests*, New Delhi, Konark Publishers, 1987.

——— Ashram Schools For Tribal Children, *New Frontiers in Education* Vol. XVII No. 4, 1987.

——— Learning Pattern Among Tribes—A Case of Yenadis (Paper under preparation)

Toppo Sita, *Dynamics of Educational Development in India* New Delhi, Classical Publisher, 1978.

6

NEW TECHNOLOGIES IN HIGHER EDUCATION

G. Ram Reddy

Introduction

For long, we in the field of education have remained indifferent to the induction of new technologies. All other branches such as industry, commerce, medicine, engineering are adopting and integrating new technologies into their professions. Education alone has maintained a distance from new technologies. As one commentator pointed out, the way teaching is done today in most institutions, it appears as though the printing press has not been invented. However, technologies are making rapid progress. If we do not harness these inventions in the cause of education we will be left far behind.

About two decades ago, a government report on the Open University in UK had this to say: "In the educational world, as elsewnere, technological discoveries are making a profound impact. Television and radio, programmed learning and a wide range of audio-visual aids have already brought out considerable changes. The most important, undoubtedly, is that the best of our teachers can now be made available to vastly wide audiences." In the light of the recent advances in telecommunications the observations of the committee appear old fashioned. The assumptions behind the educational technologies are that—(i) technology can achieve equality in the provision of education, particularly with reference to geographical location; (2) that it can lead to an increase in the quality of the population to whom the education can be made available; (3) it can lead to an improvement in the quality of education; and (4) that it can lead to economies of scale in the provision of educational facilities. The problems faced in Indian education are precisely these—equality, quantity, quality and economy.

Technologies in Education

The technologies which are currently used all over the country and in most of the formal institutions are the lectures or face-to-face instruction, and printed material. The lecture system has been in vogue for centuries and it is still the most dominant. It is very effective where it is done by a good teacher. This technology has served the purpose of education for a long time, but it has its limitations. It lays emphasis on the four characteristics: (a) teaching has to be done by the teacher; (b) it has to be done in the classroom; (c) age group; and (d) teaching has to be face-to-face. There are large sections of the people who are unable to satisfy these conditions; as a result they will not have access to education. No wonder the spread of education has been limited and there has been criticism, particularly in India, that our educational institutions are elitist. At the same time a democratic society cannot resist pressure for access to education. With limited resources the society can provide only marginal expansion. Hence the search for alternative systems. It is here that new technologies have tremendous potential and offer new opportunities.

Print Form

Books and printed material are the second important technology used in educational institutions. That books are a source of great inspiration needs no emphasis. Both in formal educational institutions and distance education organisations, printed material is a very powerful instructional medium and is likely to remain the core medium of higher education for some time to come in spite of the emergence of electronic media. Printed material has certain advantages over the technologies. These are relatively cheap to produce and the skill required to use it is possessed by the majority of adult students. Further, it provides flexibility to the students and is portable and can be used again and again.

Communication Technologies:Media

What are the communication technologies which are today available in this world ? Let me first make a brief reference to the existence of these technologies which are being used in some country or the other. I would like to add that what is new to one country may be old in another. A few advanced technologies are available only in advanced societies but others are available in developing countries also. The most important of these technologies which has been used extensively during the last few decades in different parts of the world for educational purposes is the radio. It is particularly useful to people living in remote and far-flung areas. A well prepared radio lesson can be an effective means of instruction. There are also radio conferences and tutorials. A good radio network can be of great assistance in promoting education. The second important technology is the television. Because of the visual impression the television creates great impact. It can be very effectively used for technology and science subjects where demonstrations are required. With the availability of satellite its potential is greatly enhanced. However, in developing countries like India, television is not within the reach of the majority of the people. It is costly and very few students can afford to own a T.V. set. Another limitation of the T.V. is that the broadcasting time may not suit many students. These deficiencies can be overcome if T.V. sets are made available to the educational institutions and community sets are provided to villages. Lessons can be repeated so that those who have missed can watch it at a different time.

Computer

The technology which is available and is gaining importance all over the world is the computer. Computer aided instruction or learning is becoming increasingly popular. Popularly called CAI, it is likely to become very popular in the years to come. The Government of India's project CLASS (Computer Literacy for Secondary Schools) is likely to revolutionise teaching at the school level.

Audio Video

Next, there are the audio and video cassettes. The material used on the radio and the television can be supplied in the form of audio and video cassettes to the learners. If the learners cannot afford to buy them, audio and video cassettes can be stored in the college libraries. In fact, in the years to come each library should have a good stock of audio and video cassettes. In view of the limitations of the television increasing use is being made of video cassettes. It has been found to be very useful: (i) as a method of self-study especially for weaker students; (ii) as a means for teacher training; (iii) as a means for bringing industrial progress to the classroom, and; (iv) it is helpful for continuing education in an off-campus environment. Further in the engineering education system of the country, we have inadequately equipped laboratories and 30-40 per cent of the faculty positions are vacant. In such a situation, video instruction can significantly raise the quality of on-campus engineering education in India. This is applicable not only to engineering colleges but also to colleges all over the country which do not have properly equipped laboratories and qualified teachers. The video can greatly enrich classroom instruction. Gulati and Dutta (1985) lists some of the important findings of the responses of students to the video programme. Hundred per cent students in one group felt that they were competent to conduct the tests on their own after seeing certain video programmes. Sixty per cent students in another group felt that the test procedure as explained in the video programme was better than the explanation given in the laboratory. Seventy-five per cent of students in group three felt that they would have found conducting the tests more interesting had they seen the programme earlier. Many felt that video programmes conveyed much more in the same amount of time than what is conveyed in the laboratory on account of the total preparation of content matter necessary for production of video programme. Some expressed pleasure that a programme of such quality had been produced in India by their faculty.

New developments in the electronic media such as video discs and video texts are increasing the capacity of the television set. Video disc is a system similar to the long playing record except that it carries both audio and video through a conventional television set. The video disc particularly the optical disc has enormous storage capacity. Optical discs can store 1,00,000 tracks and 54,000 on each side. The entire Encyclopaedia Britannica could be stored on a single disc with room to spare. Video Text allows home television sets to function like a computer terminal and retrieve information and graphics from a remote data base. A video text system would be very useful in disseminating general information about courses and programmes available through distance education.

In several countries telephones are used, particularly in distance education to provide interaction between the tutors and students. These, however, can be used only in countries where telephones are within the reach of the ordinary man and more important where they work very well.

There are countries which are using audio and video conferencing. For instance, in Canada tele-conferencing, is being used in several educational programmes, including professional development courses in medicine, law, teacher education, health science, business and management.

These are the new technologies available in the world and are being used effectively in some countries. However, they cannot be blindly used in all countries without relevance to the needs and development of the country. Let us take the case of India. It is a vast country which has probably the highest rate of illiteracy in the world. It is multi lingual and multi-cultural. More than 70 per cent of the people live in rural and remote areas and there are disparities between the urban and rural areas. The percentage of people who have access to higher education is less than five. Being a democracy the country is witnessing new pressures and demands for education of all types including higher education. In response to these demands, educational opportunities have been expanded but they are still insufficient; in particular there is heavy pressure on good institutions. It is, therefore, doubtful whether good formal education can be provided to all the sections, which are demanding it. "The institutional costs are very high for the coverage of the sub-continent in various languages. To set up universities and colleges everywhere, we would be bankrupt before we know it". There are also compulsions to continuing education. Given the resource constraint, there is no alternative but to think of alternative strategies. In addition to these, there is a dearth of high quality expertise; such expertise is confined to only a few places. In the alternative strategy the new technologies have an important role to play in formal universities, distance teaching institutions and open universities.

In addition to the technology being useful for teaching purposes, it can be effectively used to improve management and administration in the universities and colleges. It is fairly well-known how useful the computer is to efficient and effective management in large business organisations. Universities are large and in such matters like personnel, finance and the management of facilities, maintenance of extensive library systems, monitoring of student progress, it can be of great help.

Choice of Technology

Each technology has its own advantage and limitations and no one technology is useful for all types of learning. It is also pointed out that the mix of technologies—one supported by the other—depending upon the circumstances—will produce better results. While the technologies mentioned above are available the decision-makers have to consider the following criteria for selecting the media appropriate to their own institutions. A recent report of the Working Group, of the UNESCO

Regional Office for Education in Asia and the Pacific mentions the following five criteria for the choice of technology:

(1) *Availability*: It is important that the technology selected should be well established in the local environment so that sufficient trained manpower is available to facilitate the continued reliable use of the media. In short the chosen media must be both technologically feasible and practicable.

(2) *Accessibility:* Ideally, the chosen technology must be universally available to all students. If all students do not have immediate access to the technology, then the institution must be prepared to provide resources to engender equality of treatment of students. This may be done, for example, by making technology available to a distributed network of local area resources centres.

(3) *Acceptability:* The attitude of both academic staff and students must be favourably disposed towards the use of the technology. Without such a positive orientation the success of the medium will be severely limited

(4) *Economics:* It is evident that technologies will not be selected if they are overly expensive. In a sense, consideration of economies of scale and associated cost effectiveness is often the number one criterion.

(5) *Validity:* The technology must be appropriate for the instructional objectives and subject matter content that constitute the focus of the courses being taught by the institution. Each country and each institution will have to make a conscious decision with regard to appropriate technology—what is good for one institution need not necessarily be good for another.

Teacher

Whatever technology we use we must involve the teacher. The teacher is central to any scheme of education. If he is alienated not only will he develop an antipathy, we would not be able to use the technology in any effective manner. Technology has to be used as an aid to the teacher and his involvement in it will make the teaching-learning process very rich. This leads us to training and the reward system. We have to produce more and more trained manpower to use the technology for teaching and instructional purposes. In other words, the existing teachers have to be trained to use these technologies and once it is done the technology will be at their disposal. In the future recruitment of teachers this aspect has to be borne in mind, that is, whether he has the aptitude for making use of the technology or not. There was a time when we only emphasised his capacity to lecture. To this was added whether he/she could be a good researcher or not. In view of the technological compulsions we have to add a third requirement, that is, whether he/she has the potential for using the technology and producing software. While this calls for a massive training programme, it is necessary that this requirement is stressed as one of the essentials.

Conclusion

Social and cultural aspects are very significant and each technology has to be viewed against this background. Indiscriminate use without reference to the environment could lead to disastrous social consequences. Talking of the technology in the United States, one scientist, referring to the technologies related to the gas stove and tinned food humorously pointed out that these two technologies have made the life of housewives so comfortable that the consequent leisure has ultimately led to the feminist movement. I am sure he is a male chauvinist! There is the other instance of the impact of refrigerator and television. Refrigerator stores the food cooked and uncooked and television entertains and also provides instruction. Traditionally providing food is the function of the mother and giving instruction is the function of the father in the family. When the following question was asked in a quiz, define the western family ? Promptly came the reply that refrigerator is the mother and the TV is the father. Thus, we see that dependence of the children on the parents is reducing because of technology. Such a situation is likely to be produced in the teacher-student relationship also unless we train the teacher to adapt himself to the new situation and to continue to be in a commanding position. Technology is a tool and a servant—it is not a master. But as we have seen in some feudal systems, if the master is weak and does not know how to handle the servant, the latter will take over.

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EDUCATIONAL TECHNOLOGY FOR ADULT EDUCATION

S.K. Tuteja

Background

India is the second most populous and seventh largest country in the world. Its 780 million people represent over a sixth of the world's population. Out of this population, 63.77 per cent persons are still illiterate according to the census conducted in 1981. Low literacy rate and rapid growth of population has made it difficult to improve the standard of life of the people. Massive investment made in various development programmes have made little impact on the socio-economic development. The reduction in the rate of literacy and population growth, therefore, has become an area of national concern. The research and evaluation studies conducted by the Programme Evaluation Organisation of the Planning Commission have rightly revealed that 'the poor masses who are living below the poverty line are mostly illiterate having large families.' There is always a correlation between illiteracy and high infant mortality, high rate of growth of population, female infanticide and poverty.

Mass illiteracy was thought of by our national leaders as the greatest hurdle to our developmental goals. This is why the Father of the Nation, Mahatma Gandhi, aptly described in the very beginning that 'Mass illiteracy is India's sin and shame and must be liquidated.' After independence, therefore, the role of adult education was not only brought to the foreground but also a commitment was made to achieve literacy by the end of the Seventh Five-Year Plan, i.e. 1990. NAEP, in 1978 was one of the major thrust programmes. In this programme, special emphasis is given to the enrolment of women along with the weaker sections of society. In order to implement the programme on a massive scale besides the government agencies, the participation of voluntary organisations, NYKs, trade unions, colleges/universities, private and public enterprises, is being considerably enlarged for the rapid expansion and implementation of the programme.

The Programme

Adult education programme is a package comprising education of basic literacy skills, functional upgradation and raising the level of awareness of beneficiaries. The area and the people to be covered are so vast and varied in nature that no single method of education would be adequate for this challenging task. A large variety of approaches, methodologies and materials would have to be used for disseminating various kinds of educational messages related to the life of individuals and the community. The component of population education, being one of the important areas of adult education has been made an inseparable part of the programme. Growth of population in India is one of the major factors which has hindered development activities including literacy. It poses a serious challenge for a rapid advancement of the nation. Realising the importance of this vital area, its integration with adult education, particularly in the reproductive age-group 15-35 has become necessary. This is why the National Steering Committee on Population Education in its meeting held on 4th May, 1984, recommended that in the Seventh Five-Year Plan, suitable provision should be made for population education programme in its school education both formal and non-formal, university education and adult education sector. Considerable work, however, has been done in the field of family planning and welfare but the programme which would be taken up as part of adult education would lay emphasis more on the process of education as the main objective is to improve the quality of life of the people through a generation of awareness, understanding of the phenomenon of population growth, its causes and detrimental effect on the lives of the people individually and collectively. Keeping in view the multi-dimensional nature and the scope of adult education programme, the use of educational technology and mass media becomes imminent with a view to create a favourable environment for the programme and motivate the intended beneficiaries to participate; widen access to adult education programme for large numbers of illiterates/semi-literates/neo-literate adults; use of educational technology for designing and producing suitable teaching/learning materials; disseminate instructional messages at a faster rate; provide avenues for continuing learning and provide communication support in a massive training programme. The Working Group on Adult Education set up by the Planning Commission also recommended that

> Since we are confronted with the challenge of reaching vast masses of people in the shortest possible time, it is necessary that the full potential of mass media is utilised where teaching techniques are supplemented by the use of radio and other folk forms of communication.

The report of the Third International Conference on Adult Education, held in Tokyo, in 1972, rightly mentioned that

> Thanks to the rapid technological development of modern means of communication, it had become possible to reach far larger numbers of people than anyone had imagined even a few years ago ... Yet almost nowhere had the full potential of the mass media been enlisted in the service of adult education.

Educational Technology

The working Group on Education Technology and Distance Learning for the Seventh Five-Year Plan observed that application of Educational Technology in the Indian context must be based on greater understanding of its meaning and scope. Its wider application must be seen in the context of learning, development of audio-visual instructional materials, teaching, training, educational broadcasting evaluation, information dissemination, research and experimentation with new ideas and management of educational systems and sub-system. Accordingly, educational technology has to be considered a total system to tackle problems in the field of adult education rather than mere application of the new technology. It is in this context that adult education programmes are required to be organised in a manner to meet the challenge, and educational technology will have to play an effective multi-dimensional role in the teaching-learning process.

Situational Analysis

After the year 1947, with the introduction of audio-visual schemes for improving the quality of education, audio-visual units and State Film Libraries were set up in almost all the States. At the Centre, a Central Film Library was also set up in the National Institute of Audio-Visual Aids. The use of technological aids under the scheme had the limited objective of promoting the use of educational films and other projected and non-projected aids. During 1971-72, the educational technology project was launched with a view to stimulate the use of television as well as other instructional media including radio and film to improve the quality of education. As a result of this, the Centre for Educational Technology was set up in NCERT and Educational Technology Cells were established in 21 States in a phased manner. The programme aimed at finding alternative methods to achieve the goals of educational policy.

Experience with SITE in the mid-seventies established the potential of satellite broadcast/television by showing possibilities of effectively reaching masses including remote areas where communication and educational facilities were inadequate. Experience of SITE has led to a realisation that planning for software production is crucial to the utilisation of mass media for development.

In the context of INSAT, the Ministry of Human Resource Development had decided that the responsibility for the production of educational television programmes will be gradually taken over from Doordarshan. To this end, Programme Production Centres have been set up in the State Institutes of Educational Technology of the six states in a phased manner.

Thus, India has developed a large infrastructure of communication technology and the use of mass media is gradually increasing. All India Radio is already engaged in broadcasting certain programmes which are basically non-formal in nature and have direct relevance to adult education. The Farm House Service, the Farm School on the AIR, Programme for Women, Industrial Broadcasts, Yuva Vani, Family Welfare Programmes, are some of the programmes which are broadcast at present. Besides, specific programmes on adult education are also developed by AIR Stations in consultation and collaboration with adult education agencies and State Resource Centres which are broadcast by radio stations from time to time. The programmes are presented in the form of talks, plays and dramas, and success stories based on adult education programmes. The frequency of adult education broadcasts and durations differ from State to State.

Doordarshan

In India, the use of television, however, has been rather limited in this area. It was initially experimented for social education programme in 1959. In 1957, it was used for disseminating new information and agricultural technology to the farmers through a well-planned programme known as Krishi Darshan which is still being continued. However, for adult education programme, sporadic efforts have been made for using the television on an experimental basis. It was in 1975 under the 'Satellite Instructional Television Experiment', that TV was used for rural areas in six States of Rajasthan, Madhya Pradesh, Orissa, Bihar, Andhra Pradesh and Karnataka. Now the INSAT-1B is in operation which provides immense scope for utilising TV for various developmental and educational programmes. It also facilitated the rapid expansion of TV network in the country and almost 70 per cent of the population is now within the reach of Doordarshan Programme.

Doordarshan presently is telecasting certain programmes which are non-formal in nature and have an inbuilt component of adult education. These programmes are related to the subjects such as agriculture, civic education, science, health education including special programmes for women. Though these programmes are directly produced by the Doordarshan Kendras, they are relevant to the curriculum of adult education programme. However, in order to make them more specific and presentable for the clientele of adult education, they can be improved further in terms of their content, presentation through the process of constant dialogue and interaction between the media and the adult education agencies particularly at the stage of scripting the programme.

Special programmes on adult education which are prepared by the TV stations in consultation with the adult education agencies are being currently telecast from major TV centres such as Bombay, Madras, Hyderabad, Cuttack, Nagpur, Srinagar, Delhi and Jullundur for durations ranging from 15 to 30 minutes with a weekly or bi-weekly frequency. The TV stations in other states such as Gujarat, UP and West Bengal also accommodate adult education in the overall schedule of their programmes.

Futures

These efforts, however, are not enough to meet the requirement of a massive programme of adult education. It is, therefore, necessary to have country-wide media programmes for adult education based on multi-media and TV on the subjects of national importance and adult education curriculum. Production of multi-media packages would include supportive printed materials such as posters, charts, wall newspapers, etc. Short video programmes on components of awareness and functionality and on innovative successful experiments would have to be taken up along with the short serialised programmes on training orientation of adult education personnel. Suitable programmes would also be necessary for the States covered under the INSAT programmes. As the basic thrust of Doordarshan's Seventh Plan is to provide a three-tier TV service comprising (i) primary service in each major State to be available throughout the State in the language of the State, (ii) national service to be available throughout the country based on programmes produced at Delhi as well as programmes of national relevance originating from other centres, and (iii) local service transmitters, with provision for separate channels at the metropolitan centres. For this purpose, specific programmes would have to be designed as facilities for local programme production in each State/Union Territory as well as for more intensive TV coverage to the border areas is proposed to be made available during the Seventh Plan. In addition, the programmes related to the traditional and folk media would have to be vigorously stepped-up in collaboration with professional agencies. Thus, a large variety of software would be required for promotional programmes in which software would have to be produced for Radio and TV, traditional and folk media, publicity material including the production of short video films. Special messages would have to be designed for advertising the programme through the newspapers, magazines, etc.

Similarly for instructional purposes, literacy modules to reinforce the work of the instructor would have to be developed for use through radio and TV. Production of short video films and tape-cum-slide sequences on components of awareness, functionality and instructional audio programmes would be necessary for supplementing the classroom instruction. For the training of different categories of personnel, production of short training/orientation films on various aspects of training would be an essential prerequisite for the effective implementation of the programme as it is through such films that orientation may be provided from time to time to a large number of professionals engaged in adult education throughout the country.

In order to cope with this challenging task, the adult education agencies would have to depend heavily upon the media and educational technological agencies well versed in the production of innovative educational programmes.

Recommendations

In order to operationalise these programmes, the following steps which have some policy implications as well are suggested:

1. The choice of technology instead of one single package has to be pluralistic in the programme of adult education. At present there is much dependence on the print medium which could be supplemented by introducing new technology utilising various means of mass media for accelerating the teaching and learning process. This calls for increased support to adult education programmes by way of producing a variety of software in which specialised agencies dealing with educational technology can make a substantial contribution.

2. Since Independence, Educational Technology Cells have been established in States but they are confined at present to the programmes of school education only. The Educational Technology Cells may take up the additional responsibility of providing support to adult education programmes by preparing software on subjects like Civic Education/ Health Education/Social Values/etc., in collaboration with adult education agencies. A variety of programmes, suiting the requirements of various media, need to be designed as these programmes would serve the needs of adult education programmes as well as school education with regard to some of the common topics relevant to both areas.

3. The State Resource Centres for Adult Education in all the States are required to be strengthened for undertaking the production of audio/ visual materials with the support of Educational Technology Cells as the media agencies.

4. Employing new educational technology in programmes of adult education requires provision of sound training of functionaries engaged in adult education programmes. The training will help the functionaries to utilise new technologies for effective and speedy implementation of adult education programmes. To this end, the training of personnel concerned with this work may be undertaken by the Educational Technology Centres/Cells in which media agencies could also be involved.

5. Development of methods to enhance the effectiveness of learning, teaching and training in adult education at low cost is vital in the Indian context. This calls for strengthening the countrywide multi-media based

approach and production of low cost software including instructional and promotional programmes.

6. Management of educational technology is very crucial for its effective utilisation in adult education programmes. Some infrastructural facilities have to be necessarily created at the national and State resource centres of adult education for the application of educational technology appropriate to adult education programmes in close cooperation and coordination with the agencies concerned with the media and educational technology work. Separate financial provisions are to be made in the budget of adult education for utilising educational technology in the development of adult education programme.

Works Cited

Adult Education in India, Ministry of Education, Government of India, New Delhi, 1985

Report of the Working Group on Educational Technology and Distance Learning for the Seventh Five-Year Plan, Planning Commission, Government of India, 1984

Challenge of Education—A Policy Perspective, Ministry of Education, Government of India, New Delhi, 1985

Adult Education in Seventh Five Year Plan—A Report of the Working Group, Directorate of Adult Education, 1984

Surveys and Studies -Cooperation between Media and Adult Education Bodies, Literacy, Adult Education and Rural Development Division, UNESCO - ED-85/WS/29.

Communicator—Quarterly Journal of the Indian Institute of Mass Communication, Vol.XX, No.1, January 1985.

A Manual on Mass Media in Population and Development, UNESCO-1977.

A Draft Curriculum on Population Education for Adult Education Programme, Directorate of Adult Education, Ministry of Education and Culture, December, 1984.

8

THE ROLE OF EDUCATIONAL TECHNOLOGY IN HIGHER EDUCATION

R. Natarajan

Introduction

Education, in general, and higher education in particular, currently faces increasing demands for more effective educational experiences by the students, in the face of diminishing per student financial resources available to support this educational task. The demand for effective forms of education require the use of a great variety of methods in formal education. The use of modern educational technology offers the potential for meeting a number of challenges, in addition to an increase in productivity.

The underlying hypothesis is that educational problems can be tackled by the development of an educational technology, and that this requires the application of certain basic principles; these principles are primarily concerned with programmed instruction. The view that a systematic or scientific method should be applied to education is not new. Thorndike (1906) wrote: "The efficiency of any profession depends in large measure upon the degree to which it becomes scientific. The profession of teaching will improve:

(a) in proportion as its members direct their daily work by the scientific spirit and methods; that is, by honest, openminded consideration of facts, by freedom from superstitions, fancies or unverified guesses, and
(b) in proportion as the leaders in education direct their choice of methods by the result of scientific investigation rather than by general opinion.

Scientific understanding of the learning process, on the ways in which human beings are modified in their behaviour as a result of the events of their own life, is today playing an active part in education and business. The latest mechanical, electronic and such aids in education serve to transform the professional functions of teachers. W^ are now moving towards a systems approach to education in which courses may be planned to use the optimum media at every stage. The central philosophy underlying this approach is that of systems analysis and programmed learning whose methodology and techniques of task specification, task analysis, logical exposition, validation, active response and learner motivation may be applied to all teaching media be it television, filmstrip or chalkboard presentation.

In the preparation and assessment of educational materials, it is to be remembered that our age is characterised by the fact that knowledge and skills can and do become quickly obsolete. We must, therefore, be concerned more with student learning than with teacher teaching, with the student acquiring adaptability to meet situations of future change than with the acquisition of factual knowledge, more concerned with programming behaviour than with programming material.

Unfortunately, improvements in the delivery of university level education has been quite slow. Even though some new tools like OHPs and slide projectors, tape recorders and television equipments have been introduced into educational institutions, the basic form of teaching remains the traditional lecture.

The Problems Facing Current Educational Systems

There are many problems facing the different educational systems of the world; some of these problems, although different in scale, are international in character. Table I summarises the five major problems, along with some proposed short-term and long-term solutions. It is to be noted that when the problems are considered in combination, then the implications for education and training become more apparent. The general conclusion, however, is that education will have to become more efficient.

The Need for Innovation

The factors which are impeding education will not yield to conventional remedies. There is no doubt that better-trained teachers and administrators, more modern facilities, better teaching materials in adequate supply—in other words, sharply enhanced outlays of time, money, talent and effort—would contribute to the improvement of education and alleviation of some of its gross inequities and failures. But 'more of the same'—or even 'more of the same but better'—will

TABLE 1

Some Problems Facing Educational System and Some Possible Solutions (Ref.4)

Problems

- Population growth
- Information growth
- Demand for higher and further education
- Teacher shortage
- Existing limitations and resources

Immediate Solutions

- Increase class size
- Increase hours teachers teach
- Eliminate/reduce courses
- Lower standards
- Employ teachers with poorer qualifications
- Utilise unqualified assistants
- Improve teachers' pay/conditions
  Train more teachers
- Utilise existing plant better

Long-term Solutions

- Carry out curriculum reform,
- Carry out manpower forecasting
- Improve teaching materials, aids, etc.
- Utilise new methods of instruction
- Research into teaching methods, system and factors affecting their efficiency
- Improve teacher training
- Introduce in-service teacher training
- Make innovations in architectural design.

not get at the root of education's troubles. What is needed are radical reforms and innovations. These innovations must include the nature of the schooling process, the systems which control educational policy, and the institutions which prepare persons to be teachers.

Mark Twain's comment on British climate that everyone talks about it, but no one does anything about it, applied equally well to education. The difficulty is partly that it has been hard to see what can be done to make significant improvements. Though marginal adjustments are being made all the time, the essential features of the system persist unaltered. The usual point of departure is to consider what can be done to improve the existing pattern, rather than to ask whether the pattern itself requires reform. Indeed, the temptation is to modify the content of the curriculum, rather than methods whereby it is taught, that is, to transmit new knowledge through old channels.

It is unequivocally recognised that we are now experiencing a knowledge and information explosion. This expansion of knowledge is certainly as powerful an impetus to innovation as the expansion of numbers, and its scale has been graphically expressed in many ways. It has been said that half of all the research and development work undertaken since the dawn of civilisation has been completed in the last decade; that 70 per cent of all the scientists who have ever lived are now alive; that the accumulation of scientific data doubles every 8 years; and that as far back as 1960, research generated 60 million pages of reports each year, published in 55,000 journals in 60 languages. It is not possible to quantify such statements with any great accuracy, but such illustrations indicate the orders of magnitude involved. It may be that higher education is in even great danger of being swamped by information than by students.

There is another dimension to the problem of knowledge explosion, and that is 'obsolescence'. Campbel has defined an 'engineering parameter', T eng:

T eng = Time for a device to become obsolete/Time needed to develop the device.

The value of the engineering parameter will depend on the character of the device produced and the market for which it was conceived. In general, the numerical value of the engineering parameter will decrease as time goes on. It would appear that as the need for reliability and sophistication of a device increases, its life span tends to decrease, whereas its development and production time increase. A dynamic national economy would demand a numerically small engineering parameter. However, this immediately places a burden on engineering education.

A second dimensionless parameter, T ed is defined as :

T ed = Useful life acquired knowleged/ Time needed to acquire knowledge.

This may be called the 'education parameter'. It is evident that the denominator, namely, the time needed to learn, is large, whereas unless we choose wisely, the numerator is relatively small. Thus the education parameter tends to have values less than unity. Actually what is necessary is that the educational parameter be greater than unity, in fact, much greater than unity. In attempting to achieve this, it is evident that the magnitude of the denomitator can be reduced by using new methods of teaching, visual aids etc. The numerator may be enlarged by emphasising those concepts which are of a lasting nature.

In the field of education, to innovate is to create something new which markedly deviates from traditional practices which have been followed since a long time to impart education at different levels. Various innovations have been introduced as ways to break out of the rigid system which propels students through a series of identical classrooms in which teachers do most of the talking and students have little opportunity to respond. Among these innovations are team-teaching, independent study, curricula focussed on helping students discover things for themselves rather than on trying to tell them everything, colleges designed for maximum flexibility so that students can work alone or take part in group instruction via diverse media. The aim of all these innovations—organisational, curricular, and technological—is to adapt instruction more precisely to the needs of each individual student.

In theory, there are three possible innovation strategies. The first is to change everything at the same time, but so far there has been no instance of this having been done anywhere. The second one involves modifying the existing state of affairs by introducing innovation at the lowest level in the system and carrying on from there, the new system pushing the old one in front of it; for example, the gradual introduction of TV. The third strategy involves setting up and developing a new system parallel to the old one and capable of replacing it one day; for example, the Open University system. In the long term, that is no doubt the most effective strategy.

The Role of Technology in Education

Technology is a force of significance in most aspects of modern civilisation, and it is no less significant in the field of education. With new media and instructional technology, individualisation is not only economically feasible at the present time, but is actually required if universities are to accomplish their mission on an efficient basis. It is not necessary to have sophisticated technology in order to individualise learning; many audio-visual resources currently in use are quite well suited to this application. It is also important to recognise that the term technology refers as much to a 'process' as of hardware and media alternatives; thus it is necessary to examine how the process of technology may alter the man-machine relationship in the years to come.

Educational Technology or Instructional Technology is based on the belief that technology, properly supported and widely employed, could help meet some of the nation's most pressing educational needs. The stress must not, however, be on technology, but on learning. The heart of education is the student learning, and the value of any technology used in education must therefore be measured by its capacity to improve learning.

Technological media enable the adaptability of the educational process to the individual student's differences—in pace, temperament, background, and style of learning. These media can perform many of the following functions involved in the educational process :

1. They can store information until it is needed or wanted;
2. They can distribute it over distances to reach the student wherever he happens to be, instead of bringing him to the teacher;
3. They can present the information to the student through various senses and in many modes;
4. They can give the student the opportunity to reach the material and respond in many wsys.

Educational/Instructional Technology

There are different ways of explaining or describing this concept. In the 1960's, the dominant idea was 'technology in education', but this is obsolete today. It is now defined as 'a rational problem-solving approach to education, a way of thinking especially and systematically about learning and teaching' (Rountree). Here the meaning of educational technology is 'technology of education'.

Gagne describes educational technology as meaning 'the development of a set of systematic technique, and accompanying practical knowledge for designing, testing and operating schools as educational systems'. The basic feature of this definition is that technology as used in the phrase 'educational technology' or 'instructional technology' emphasises the broad processes of techniques for logically arranging things, activities or functions in ways that could be systematically observed, understood and transmitted.

Educational technology, with its concomitant system emphasis, is concerned with the relation, performance and interaction of the various units of the formal and informal education systems. Educational or instructional media are simply the forms or means of conveyance of messages to the audience within the educational domain. While the term 'media' generally arouses images of some type of 'device' or educational product, it is important to note that recent definitions do not require a concrete object, but may include such things as field trips and laboratory exercises.

Educational technology is usually conceived of as addressing itself to the twin goals of improving educational effectiveness (meaning 'success in achieving objectives') and efficiency (meaning 'optimum relationship between output and input'). Following the definition of technology in general as the systematic application of knowledge and techniques to practical processes, educational technology places stress on educational methods and modes of organisation rather than on technical devices. The mechanical apparatus of education is merely a means to an end, and has no virtue in its own right.

Educational technology has also been described as a systematic approach to instruction, where the objectives are defined, the logical blocks in the argument worked out, and students tested for their ability to absorb the blocks at different rates in different sequences etc. According to this definition, a good textbook is an example of educational technology, especially if it happens to verge on a programmed text.

Instructional technology has also been defined in the following two ways. In its more familiar sense, it means that media born of the communications revolution which can be used for instructional purposes, alongside the teacher, textbook, and blackboard. The components that make up educational technology include television, films, overhead projectors, computers, and the other items of hardware and software. In nearly every case, the media have entered education independently, and still operate more in isolation than in combination.

The second and less familiar education of instructional technology transcends any particular medium or device, in this sense, instructional technology is more than the sum of its parts. It is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction. This comprehensive approach may be considered to hold the key to the contribution, technology can make to the advancement of education.

Instructional technology, by either of the above two definitions, includes a wide array of instruments, devices, and techniques, each with its particular problems, potential, and proponents. It is important to note that neither definition equates technology with 'machines'. Many observers believe, for example, that fascination with the gadgetry of instructional television to the exclusion of the idea behind it has often led to stereo-typed and impoverished uses of that medium.

According to another viewpoint, instructional technology involves the management of ideas, procedures, money, machines, and people in the instructional process.

Many people see instructional technology primarily as a way of recording, storing, transmitting, distributing, and displaying material. But equally important is its capacity for response and feedback and for reinforcement of learning. Programmed learning, for example, provides immediate, constant, and infinitely patient feedback. Another quite different example is the use of videotapes in teacher education ('micro-teaching'), which gives teachers a new way to see themselves, to analyse small units of their own teaching, and to improve their methods as a result.

The basic purpose of educational or instructional technology is to arrange the various educational media in concord with the other resources of education to achieve or contribute to a higher quality and/ or quantity of output from the educational systems. The five major areas where progress in educational technology has been, and is being made, are :

(i) making the teaching-learning process more visible
(ii) increasing labour-specialisation in faculty

(iii) improving concepts of measurement and evaluation of aspects of the education system.
(iv) objectifying goals and clarifying intentions of instruction
(v) shifting the factors of production toward less labour and more instructional materials and equipment.

The progress in these areas does overlap considerably.

Educational Technology Compared with Traditional Approach

It is instructive to attempt a comparison of the traditional approach to education with the approach represented by educational technology. Appendix II provides this comparison; the factors have been divided into two major sections, the first pertaining to the basic operation of the classroom and the second to the manner in which instructional materials are prepared for use in educational environment.

Criticism of the Conventional Approach

The conventional lecture, supported by textbooks, has provided a lock-step instructional system for mass instruction. This system assumes that all students in each course have the same educational background, learn at the same rate, and respond to identical teaching strategies. Recent increases in enrolment have helped to indicate that the lecture method of educational delivery has some serious limitations. As classes have become larger, it is increasingly difficult, or even impossible, to interact personally with each student to aid in the understanding of the lecture material. During a lecture, the majority of the students listen passively while only a few students ask questions or actively answer questions. Studies in pscyhology have shown that, for the average student, passive listening is a very ineffective way to learn.

Teachers tend to deliver information to their students and expect them to parrot it back to them. The students are programmed to be memorisers and are penalised for thinking and questioning. Surveys of teachers have shown that most teachers feel that their main purpose is to help students think. While this is a laudable purpose, teachers often deliver information and then expect the students to return that information to them, uncontaminated by their thoughts and ideas.

In Support of the Educational Technology Approach

Sections 4 and 5 have detailed the various merits of the Educational

Technology approach. It is felt that perhaps the greatest advantage accruing from the advance of technology into the realm of education is the opportunities it provides for a careful scrutiny of educational objectives and techniques.

Criticisms of the Educational Technology Approach

Some teachers feel that it is absurd to believe that any machine, including TV, can teach as well as an intelligent and well-trained human being who enjoys doing so. It is believed that the net effect of the machine approach to education is to separate the student from books even more than he already is. A state commissioner of education in the US was reported in the press as announcing that "the alluring but misleading image of the so-called master teacher performing before the camera" results in "impersonalised, dehumanised teaching and an increase in distance between pupil and teacher".

It is argued that few of the more important ways in which human teachers interact with students can be electronically simulated, and that the dominant educational medium will continue to be the printed and spoken word rather than the image on the screen. Technological solutions to educational problems often have a seductive appeal, promising to make education easier and more enjoyable than ever before; most of these, however, fail to fulfil their early promise.

The disappointing rate of progress of educational technology is considered to be due to the fact that education is the development of people, and people are not machines, or even machine-like. Since educational technology operates at the person-machine interface, it is instructive to consider what makes people so essentially non-machine-like:

(i) While we have conscious experience, machines are not conscious; they can receive input but they cannot perceive it; they can be damaged, but they cannot be in pain.
(ii) While we can emphasise, i.e., we have an intuitive understanding of the conscious experience of others, a machine cannot.
(iii) While we do not need to be logical and have other modes of intelligent thought, machines are not so.
(iv) Unlike people, a machine only responds; it does not initiate. Furthermore, its responses are either totally rigid or random in an

unmistakable machine-like way. Machines have no subtlety.

(v) While a machine is incapable of satisfying social needs, people need people in ways in which they do not need machines. Machines cannot be warm, sympathetic or encouraging, even if they can be made to pretend to be.

Thus it only makes sense to use machines to support teachers, not to replace or mimic them.

Perhaps the greatest blunder in instructional innovations in the '60s and '70s, some people say, is the attempt to implement "self-paced" instructional systems. They seemed to be a natural improvement on the conventional lecture system, since equipment such as audio tape recorders would allow a student to learn at their own rate. He could analyse the explanation, replay any portions not comprehended, and advance through the tapes at his or her own rate. Highly motivated students could complete the course quickly. Faculty members could act as consultants and tutors to help students on the difficult parts. The educational system would thus take on the ideal form of one teacher tutoring one student.

However, it was doomed to failure because of procrastination. People began to find that like drinking and driving, procrastination and self-paced learning do not mix. When the other courses in the curriculum were not self-paced, students were ignoring the self-paced course and completing the material required in the other courses. Investigation of self-paced systems revealed that they were successful for the mature under-graduate learner and for motivated adults in continuing education programmes. True self-paced courses for immature undergraduates posed serious attrition problems. In order to be successful, the self-paced system had to incorporate many hidden checkpoints, deadlines and feedback of progress to faculty members. In other words, they were not self-paced!

The procrastination problem could only be solved by providing students with precise schedules, specifying deadlines, and scheduling group tests over the assigned material in the course schedule. Self-pacing does not exist only for students who are ahead of the required schedule. Talented students are able to complete the required course content in less time, while the remainder are required to keep the normal schedule.

The Role of Different Media

In a general sense, educational media include texts, work-books, programmed books and other print materials; tapes, records and other audio materials; filmstrips, motion pictures and other photographic materials; games, apparatus and a number of other manipulative materials; charts, signs, maps and other graphic materials; dioramas, bulletin boards, felt boards and other displays; as well as other resources which serve as the carriers of messages. Many of these media based messages are accessed by the individual learner in his classroom others are obtained in a college resource centre, and still others may be obtained from remote locations. This list does not exhaust the possible means and methods that may be needed for designing the complex requirements for optimally stimulating academic learning. While most of these media had their origins outside education, and their goal was entertainment rather than education, their potential for improving the effectiveness of the learning process has been recognised now.

The multi-media system of instruction has now replaced the pathological syndrome of single medium fixation, so characteristic of the early 1950's. There has also been conceptual thinking about the media. They are carriers of information; empty channels and raw tapes, films and paper. The basic complex problem is to select the most appropriate modes of communication for learning strategies and put these into combinations. The selection of media involves the matching of the characteristics of the media to the demands of the instructional situation—the characteristics of the instructor, the content, the student and the environment. An attempt is made here to summarise the purposes for which the new media are being employed:

(i) New media can be used as aids to the presentation process. This has traditionally been the usual point of entry for new devices and techniques into the process of teaching and learning. As a matter of common observation, the use of audio-visual materials seems to add clarity and precision to the way the content of a particular lecture or teaching session is presented. The mere discipline of seeking out, or preparing for one's self , materials that are suitable for one's course probably adds a great deal to its educational effectiveness. There are other closely related results of audio-visual procedure associated with clarity. One of these is accuracy. A carefully drawn diagram using colour (and possibly, in the case of overhead projector transparencies, several overlays) is preferable to a hastily drawn and sometimes inaccurate blackboard sketch. It is not only the efficient presentation of the material to the student that is involved here; the lecturer also derives considerable convenience from having high-quality materials at his fingertips. He saves time in the class, and undoubtedly saves preparation time in the end.

(ii) Media can be used as aids to demonstration. In addition to some evidence that interest is aroused and that learning is enhanced by new methods of presentation, there is a whole series of teaching objectives which can be better achieved by new media.

(iii) Media are used as aids to solution of logistic problems. The arguments for using media as aids to presentation depend upon the hypothesis that they 'improve' teaching and learning within the existing framework. One of the major characteristics of the newer technology is that it transcends many of the traditional patterns of the teacher in the classroom. As long as the process of educational communication depends upon the range of the human voice and eye, and upon the organisational constraints which brought a limited number of students together in a room with a teacher, a great many limits were placed on flexibility. Once educational materials are available in a recorded form, it is possible not only to permit repetition and frequent access within an institution; high-quality learning materials can be deployed throughout an educational system, to give students opportunities which previously did not exist. Therefore the concept of "access" leads to many new ways in which universities might organise learning situations.

(iv) Media can be used to promote interaction in the teaching and learning process. The new resources cease to be mere aids to an existing teaching pattern; by a reciprocal process, they become more integral to the teaching and learning process.

(v) New devices and techniques can be used as aids to the assessment process.

There is no obviously convenient or generally accepted system for classifying learning resources; usually they are classified on the basis primarily of information sources.

Television

The potential of TV for education lies in three main directions:

(a) It can show things that would otherwise be difficult to see because they are of an inconvenient size, too far away, or too complex;
(b) It can transcend the limits of space and time either by open-broadcast, closed-ciruit or recorded transmission;
(c) It can be used for evaluation of performance.

The TV set in the classroom can receive programmes, either live or pre-recorded from central broadcasting studios. Or it can be employed as an independent audio-visual unit through the means of video tape.

In the broadcast made, dissemination of TV programming can be accomplished either through the use of ground stations or airborne equipment, or by means of closed circuit television (CCTV). Broadcasting for instructional use by educational institutions, either to the school or the home, is referred to "instructional television" (ITV), to distinguish it from "educational television" (ETV), which serves a broader cultural and informational service to the general public.

With very few exceptions, TV is usually dumped on established curricula and administrative systems. As such, it becomes an addendum., an adjunct, and ultimately an insignificant item in the annual budget. ITV has been called a "teaching tool" and "an aid to teaching", both of these implying that the medium is something to be added to the present modes of instruction.

What is happening to students exposed to TV remains fundamentally as mysterious as what is happening to them through books, field trips, overhead projections and efforts of teachers in classrooms. The question always becomes one concerning "education" and not concerning a "medium". Television does not teach; teachers teach.

Still, "Can TV teach?" is the question that has been asked since this medium first appeared in classrooms.

The appendix summarises the general conclusions reached on the basis of research on learning accruing from the use of TV.

Audio-visual Materials and Equipment

A variety of materials to aid instruction has been available to the colleges and schools for some years, employing the use of such equipment as tape recorders, record players, slide and filmstrip projectors, overhead projectors, motion picture projectors and radios. Whether these employ sight or sound, or both together, they are grouped as audio-visual materials. They are also frequently referred to as "conventional aids", though this term is somewhat misleading.

Another important development is the increasing emphasis on the use of audio-visual resources for independent study. This has led to the concept of the learning resource centre. Usually a learning resource centre has learning booths or "Carrels", in which individual students can use slides, filmstrips, film loops, tape recorders and books.

There is a fundamental question whether audio-visual materials are a means of instruction or merely aids or adjuncts to instruction. Basically, they are amplifiers, which extend the range of the human voice, the eye, and ear; alternatively, they bring distant sights and sounds into the classroom. As such, they are or can be a means of instruction just as a textbook is. But whereas books are taken for granted, audio-visual materials are often introduced or not, largely at the whim of the teacher.

In higher education, resistance to the use of audio-visual materials is usually attributed to the following reasons :

(i) Faculty and administrative inertia.
(ii) Unavailability of films, equipment, or operators when needed.
(iii) Lack of equipped classrooms or other viewing areas.
(iv) Problems of obtaining the right material when needed.
(v) Lack of budget to provide decentralisation of certain materials and equipment.
(vi) Unavailability of appropriate materials.
(vii) Limited time of instructs for locating or designating appropriate materials.
(viii) Lack of information about sources.
(ix) Lack of technical assistance for preparation of materials.

The *Journal of Chemical Education* has been publishing a series of science experiments on the Overhead Projector known as "Tops".

Language Laboratories

The purpose of the language laboratory is to develop listening and speaking skills in foreign languages. The system employs individual study carrels (booths) and the use of audio tape equipment and headphones in combination with other materials. For reasons of convenience, these facilities are housed in one place, as opposed to being portable or mobile. The maintenance of the complicated electronic components is a highly skilled jobs, requiring an appropriately skilled staff.

The Computer

The computer has three main uses in education: it is a research tool; it is a management tool; and it is a teaching-learning machine. While the role of the computer in higher education for the purposes of research and management is well established, the proposition that a computer could also become a potent new vehicle for teaching and learning is more recent, but it is being taken up with considerable enthusiasm.

The potential applications of the computer to teaching and learning are of two main types; those which are essentially similar to existing applications of computers; and those which are dependent for their realisation on the development of new techniques. The widespread provision of computer facilities could have a marked effect on the curricula of higher education. It would allow a much greater use of problems involving computation, since the student would still be able to concentrate on the main principles without being unduly distracted by routine computational demands; and it would encourage successive approximation approaches to optimal solutions.

In Computer-Assisted Learning (CAL), the computer is used as a highly sophisticated teaching machine, which can replace and surpass many but not all of the functions of a human tutor. Computer-Assisted Instruction (CAI) employs a central computer with electric typewriters, light pens, audio tape, and other equipment as terminals for the use of students. The system can be used in various modes of instruction, as for example, drill or practice, inquiry, tutorial instruction, etc.

Many educationists view CAI as including anything a computer can do to help individualise and improve instruction. Thus the term encompasses not only the direct tutorial dialogue between computer and students, but also automated data-management aids to help instructors and administrators design curricula, monitor student performance and manage classroom instruction.

In this context, a distinction is made between "individualised instruction" and "individual instruction". Individual instruction implies that the student is moving entirely independently, with little or no interaction with his fellow students. Such instruction cannot, in itself, provide a total education although it may do an excellent job of teaching certain skills. Other, equally important skills require group interaction.

Individualised instruction, as distinguished from individual instruction, means that the mode, content, and sequence of instruction are tailored to the individual's needs at any moment in time; it does not necessarily mean that he studies by himself although he may in particular circumstances. Thus, in a single lesson a student might spend part of his time in self-study (e.g. with a programmed textbook) part of his time watching a film in a large auditorium, and part in a group discussion, yet the entire lesson sequence might be highly individualised.

A modern computer has characteristics that closely parallel those needed in any educational system that wishes to provide highly individualised instruction. First, it has a very large memory capacity that can be used to store instructional content material or, under certain conditions, to generate such material. When the material is stored externally, as in reference books, films, etc., the computer can maintain records of the location and nature of the material for subsequent referral. Second, the computer can perform complex analysis of student responses inserted by keyboard, punched cards, electronic pen, or other techniques into the computer. Furthermore, a computer can make decisions based on the assessments of student performance, matching resources to individual student needs.

The use of the computer for the management of learning represents an intermediate stage between its use for computation and data processing and its use in CAL. Computer-Managed Learning (CML) derives originally from the use of computers for the analysis of text and examination data.

The Computer-Based Education (CBE) System employs a variety of personnel including system programmes, lesson-writers or teacherprogrammers, curriculum and evaluation specialists, teachers from regular classrooms, engineers who teach, programme, or design equipment for the system, system operators, and technicians who maintain the system and aid the engineers in their developmental research

The following specialists are needed to create and operate the CBE systems:

(i) Computer Engineers who are thoroughly familiar with the basic principles and practices of programming and with the basic techniques and principles involved in designing all components of a computer system. They are experts in video displays. They are, however, untrained in CAI and computer technology as applied specifically in educational systems.
(ii) Lesson-Writers who are trained in colleges of education. They have learned basic educational principles, in particular, the application of these principles in classroom instruction. They, however, have no technical background in engineering or science, and none in technical subjects related to computers, other than programming experience.
(iii) System Operators who are the interface between the CBE system and each user of the system. They know the system thoroughly and can cope with all commonly occurring failures of software and hardware in the system. They have, however, little knowledge of the specific educational purposes of the courses taught by the system.

In order to find, for each specific course or lesson, the most effective combination of CAI and classroom instruction, it is instructive to compare the respective capabilities and limitations of the two forms of teaching. In comparing the live (or animate) teacher to the inanimate teacher, viz., CAI, the following questions about the effectivity are relevant:

(i) Can a computer replace or simulate the warmth of the live teacher?
(ii) How essential is this warmth to the learning process?
(iii) How does each type of teacher add glamour to the class, or the treatment of subject matter?

Next the impersonal characteristics of the two 'teachers' are compared:

(i) How do they compare with respect to patience, speed or response, and the ability to individualise the treatment of each student?
(ii) What is the variety and scope of subject matter than can be handled by each and with what degree of flexibility?
(iii) Can each be creative and intuitive in the development of particular talents of individual students?

Both teachers and CAI lessons communicate with the students and facilitate his ability to communicate the ideas that he has learned.

(i) How limited or complete is the communication afforded by the teacher and by the computer?
(ii) Is just one sense involved, or, are all five?
(iii) How varied can the communication be? (Lecture, Dialogue or Discussion)
(iv) How does each facilitate opportunites for the intergroup type of communication that aids social development?
(v) What ranges of communication ratios are available?
    (a) What facilities are available to each student?
    (b) What use can be made of audio-visual aids in the regular classroom and on CAI?
    (c) How can they be implemented in each system?
    (d) What access does the student have to these aids?

The wide range of questions listed above should make it clear that the new educational resource, CAI, must be used with considerable imagination, freedom and sensitivity. In order to make it effective, it is important that teachers and prospective teachers come to understand the following capabilities of CAI:

(i) CAI can liberate its patience, accuracy, and perfect memory are ideally suited to the part of remedial instruction that depends upon these capabilities. Human teachers have only finite patience, accuracy and memory.
(ii) CAI is powerful unlike the teacher, it can do computations accurately and rapidly, both of arithmetic and of a logical nature. It can produce elaborate graphs and drawings and perform

sophisticated retrieval of information from large data banks.

(iii) CAI is very flexible: It can perform in any style or logic of teaching that can be defined by the lesson-writer or curriculum designer.

(iv) CAI is compatible with live teaching: It can be used side-by-side or alternatively with person-to-person or "live" teaching.

(v) CAI can evaluate: the retrieval and computational powers of the machine can be used by the teacher to get immediate evaluation of student performance.

There are two dominant modes of computer assisted learning:

(i) the computer as a tutor, deriving from the programmed instruction movement of the 1950's and 1960's; and

(ii) the computer as a laboratory, including simulation, modelling, problem-solving, calculation, data bases, deriving from the changing nature of certain academic desciplines as a result of the impact of computing technology.

CAI and computer as a laboratory attempt different objectives, and are therefore not strictly comparable. CAI is mainly a direct teaching medium capable of helping with quantitative problems of mass education. The computer as a laboratory is a learning resource to be added on to direct teaching—often in the very traditional "enrichment" manner of much audio visual technology/educational broadcasting. The computer as a laboratory is aimed at solving qualitative rather than quantitative problems. CAI generally speaking, has given computer assisted learning a bad name. The public image of CAL still tends to be of a child sitting at a terminal being taught, programmed learning style, by a machine instead of a teacher. The inflated claims made for CAI and the precedence of publicity before performance have created a loss of credibility.

Criticism of Computers in Education

It is pointed out that computers are no different in principle from other machines, despite their remarkable capacity for storing, retrieving and manipulating data. Computers are not brains, nor do they have brains. They do not think, they process. They are lightning-fast and totally infallable, but they are mindless. CAI cannot be sensibly used as a substitute for either teachers or books. While computers can be programmed to do some of the things the teachers do, e.g. given information, exercises and tests, they cannot deal with unexpected questions or unprogrammed misunderstandings. Human educators are intuitively able to do this rather well, but intuition cannot, by definition, be programmed. Although a computer screen can be used for displaying text, it is an uncomfortable and unsatisfactory substitute for the pages of a book.

The Dean of the Royal Naval College at Greenwich made the following comment : "I have never been able to understand the logic of trying to replace the human teacher by a computer in the classroom teaching role; after all the human can be described as an extremely sensitive, adaptive control system and is much superior to any computer in that particular role."

The major problem facing CAI system is that the simple models of the learner in the software not only attract academic criticisms but also run the danger of not utilising the computer's powers sufficiently. Extensive research on CAI performed mainly in the US shows fairly conclusively that CAI is probably no better and no worse than traditional instruction, that CAI cuts down the time needed to learn significantly, and that the weaker student (but not the weakest nor the strongest) is probably helped by the method.

What Computers are Good for

The computer is ideally suited to applications involving the solution of complex equations in the various topics of control theory, physics, and the like and is therefore a very useful teaching tool to bring home to the student the effects of altering the parameters of the problem.

The history of man/machine studies to date suggests that we should try to go for a complementarity of function between man and machine. That is to say, the machine should do what it is good at (for example, solving partial differential equations at high speed), and the teacher should do what he is good at and wants to do (for example, deciding on the basis of what he knows of the student, which assignment or question to assign him).

Computers are versatile educational aids. They can be used to simulate a great variety of processes—economic, mechanical, physical, chemical, etc. and they can also be used to perform complex and otherwise time-consuming calculations. They are also useful for recording students' progress, for administering and scoring objective tests and for directing students to appropriate parts of a curriculum (Computer-Managed Learning or CML).

When used as simulators or calculators, computers can provide valuable processing power, and can even help students to develop new insights. They enable students to test hypotheses, to investigate the effect of varying parameters on dependent variables and to explore and compare a variety of possible experimental outcomes without, actually performing the experiments. When a student is using a computer in this fashion, it becomes a tool for creativity and discovery.

Instructional Radio

Instructional radio can be defined as the use of radio transmission in any systematic process of education to extend the competence and intellect of the audience. Programming in this category is, for all practical purposes, restricted to stations operated by non-profit educational institutions. This definition excludes the commercial programming which constitutes an overwhelming majority of the radio industry. In a way, this is unfortunate because the commercial area of broadcasting represents such a demonstrably potent social force that some even say the mass media themselves have become the "message", and that programme content is insignificant in comparison with its mode of transmission.

Feedback Device

The purpose of feedback devices is to supply knowledge of results when a student or a group of students are questioned on what they have learned. When the question is also presented by the device it is called a "teaching machine"; but when the question is posed by a teacher it is usually referred to as a "feedback classroom". Teaching machines are normally divided into three categories, adjunctive, linear and branching.

Accessing Devices

Most accessing devices can be divided into two categories: reprographic devices, which enable the student to take copies of a resource, and which require the physical presence of an original; and dial-access devices, which enable the learner to examine a data bank located at some distance, but do not enable copies to be taken. The impact of reprographic devices on education is already condsiderable. The paperback revolution has become institutionalised, and now we are in the midst of a photocopying and xeroxing revolution. These devices offer an escape from the use of a single textbook or a few scholarly works as the main source of information.

The Role of the Library

The library represents the largest, the most traditional and the most accepted organisational form of support service in teaching and learning. In recent years, libraries have begun to consider the use of learning materials which are not in the form of books but take a variety of different forms—films, audio tapes, video tapes and tape-slide combinations—"non-book materials" as they are sometimes called. They bear little resemblance to the book; often the information they contain cannot be retrieved or displayed without the aid of specialised land complicated equipment. The emergence of multi-media learning materials poses a problem for any library. In some institutions, the media materials centre is set up separately from the library. When this is done, the two activities tend to develop in isolation; and even in competition with each other The media centre is driven increasingly towards an emphasis on hardware, as its distinctive feature, and in the library there is a defensive retreat to classical bibliographic tasks. It is reasonable to expect that the users' interest will be best served by an integrated approach to the whole range of educational media, including print.

Furthermore, the cost and speed of reproducing page images have been improving in recent times to the point where this technology is beginning to have significant influence on the availability and flow of scientific and technical information. One implication is that, to an increasing extent, libraries will be able to distribute expendable copy instead of lending materials.

The Book

QUESTION: What educational device can be used by anyone without disturbing the neighbours?

CLUE: It has no batteries or wires, is cheap and silent and contains data which can be sequentially or directly accessed.

Answer : The Book.

Those who fear that TV or CAI will take the place of reading should be reassured that the book is here to stay. More information can be provided more conveniently in book or pamphlet form than in any other. One of the chief advantages of the book over oral instruction is that the pupil can go at his own rate, whereas in oral instruction, the teacher sets the pace, which may be alright for the average, but is likely to be too slow or too fast for others.

The book is considered by some to be the "educational supermedium. No technology has come anywhere near matching it for versatility, economy and effectiveness. It has survived the introduction of radio and TV and many feel that it will equally survive the onslaught of the silicon chip. Microchip technology will, of course, help to produce better books. The direct use of word processors by authors will facilitate effective and creative writing and obviate transcription errors.

Evaluation of Use of Educational Media

Many of the evaluations of educational media have been based upon an experimental research model. A recent meta-analysis (an analysis which quantitatively combines the results of several studies) of outcome studies of visual-based instruction has revealed that "74 per cent of the studies of student achievement reported no significant difference between visual based instruction and conventional teaching."

Experimental studies do not, in general, significantly favour the use of TV, when the criterion used is student achievement. In a discussion of such findings, Bates has criticised the predominance of laboratory-controlled experiments in such studies. He argues that it is not surprising that the majority of findings have no significant differences because :

(i) important variables such as quality of television programme presentation are often ignored.
(ii) differences in quality between the experimental and control media (e.g. televised lectures, textbook) are not controlled.
(iii) individual differences in response to different media are not considered.
(iv) organisational and structural variables (i.e. how the media are to be integrated into and relate to other teachings methods) are often ignored.

Some Considerations of Instructional Effectiveness

Much of the rationale for the use of audio-visual aids in instruction is based on a view which relates instructional effectiveness to the number of sensory channels employed in the teaching process. The use of radio has been questioned on the grounds that the ear is not the most efficient channel of communication. It has also been suggested that at any given time during communication, one sensory channel of the receiver seems to predominate, and that simultaneous presentations through two channels results in blocking of one. Obviously, a multi-channel communication presents options to the receiver that a single-channel communication does not; however, it seems that the receiver can seriously attend only to one channel at a time. Some evidence suggests that the use of visual images will improve learning of manual tasks, as well as other learning tasks, where visual images can facilitate the association process. Otherwise, visual images may cause distraction and interfere with learning.

In educating students, particularly in professional courses, such as engineering, it is important to analyse what employers look for in graduates. Placement Centres have found that there are at least three major characteristics that employers are concerned about:

(i) That employees are able to take an assignment and get the job done.
(ii) That they are able to write a succinct report.
(ii) That they are able to make an oral presentation to the boss or a committee.

It therefore follows that teachers should give students practice in developing ability in these areas.

Enough is known from studies of human learning, motivation and other related areas of psychological research, for us to realise the importance of teaching the right things, at the right level, at the right time. 'Right' here may be taken to mean congruent with the student's perception of his/her own needs and interests. Teacher does not know best. In today's classrooms students are too passive and teachers talk too much. Effective education needs to be centred on appropriate learning activities. New curricular designs must be introduced in which teachers do less teaching and do more organising and controlling of student centred learning. With reference to educational technology, it is human development which should take precedence over infrastructure development. Teachers also must not waste their valuable time doing the things technology can do better and cheaper.

Concluding Remarks

The outlook for future must recognise the tremendous potential possessed by modern instructional technology for enhancing the effectiveness of student learning. However, instead of continuing to let the machine do only what the teacher cannot do, we should ask ourselves what it is the teacher should do that the machine cannot do.

Speculation on the impossibility of new educational capabilities has led to a kind of future capability which represents a new dimension, rather an extension, of education. The capabilities discussed above are all, in a sense, reimplements of educational psychology—centred especially on perpetual problems and issues. In other words, they are all "outside" of the individual; they stop short of making direct changes in the organism. Rather, they attempt to make it easier for the organism to change itself.

Technology forecasters predict the emergence of capabilities for making direct changes in the organism for learning purposes. Such things as laser beam technology, advances in endocrinology, bio-chemical control or genetics, and pre-conscious cognition techniques will provide both an exciting and somewhat frightening educational capability. They will be exciting because of the tremendous potential for enhancing learning; and frightening because they would entail moral, ethical, and philosophical problems.

Particularly, in a country like India, where equipment maintenance is given the back seat, it must be remembered that none of the modern equipment for educational technology is of any educational use unless it is in the right place, at the right time, in working order, and in the control of a teacher who understands its applications. In order that all this should happen, organisation and training are necessary.

In spite of all the merits claimed by proponents of educational technology, it has not become as prevalent, and also because of the human belief that almost everyone favours change as long as the change is for someone else. It must be admitted, however that regardless of the excitement generated by new developments in educational technology, many of the most important questions about education remain unanswered. As has been said, we have "new chips, but old problems". It appears that development of technology is easily outpacing the development of educational know-how. In higher education, at least, it is believed that faculty will continue to teach advanced undergraduate and graduate courses in the traditional lecture mode, and they will spend more time on research and personal interaction with students.

APPENDIX - I

Traditional Approach (Ref.3)

1. Factors Pertaining to Basic Operation of Classroom

Educational Technology Approach	**Traditional Approach**
1. Learners are informed of the objectives, and how achievement of them will be measured.	1. The learner generally receives only a partial idea of what behaviour he will be required to demonstrate, and frequently does not know how to study for a test.
2. The materials available to achieve the objectives cover a range of media, and combinations of media, with possibilities for choice of preferred media by the student.	2.Materials are generally limited to two media, the textbook and the teacher, and rarely does the student have a choice of a preferred medium.
3. The purpose of student evaluation is to help the student by providing feedback on performance, diagnosis of strengths and weaknesses and providing information for making decisions such as scheduling, extra help enrichment, etc.	3. While tests are supposed to be used for diagnostic purposes, they are generally used only to establish grades, i.e. as a summative evaluation over a unit of content. Decisions are of a 'go or no-go' nature.
4. A uniformly high level of student achievement is expected resulting in highly skewed test scores, with little variance.	4. Normal distributions are expected, as it is assured that there will be variance in student ability. If too many

	students have a high score, the test may be rewritten to include more difficult items to include more difficult items to bring about the 'normal distribution'.
5. Time required to master the material may vary across students, and may be correlated with I.Q.	5 Time for completion is constant for all students, being the planned length of a 'period' or the amount of time allotted by the teacher for the given topic.
6. The teacher's role is not to teach (in the sense of subject matter presentations), but to manage the instructional environment, diagnose students, direct the use of available resources, coordinate information, etc.	6. The teacher is primarily responsible for all subject matter presentation, and also must prepare and administer tests and manage the 'housekeeping' details.
7. All materials used in the classroom (instructional environment), including new media, conventional media, teaching personnel, measurement techniques, etc., are coordinated and controlled by a plan which clarifies interactions, responsibilities, etc.	7. The plan for control of the classroom is simply the teachers' general (usually unwritten) idea of who should do what, in what sequence, and within what periods of time. General guidelines are established by the administration, so that at least the time periods are the same.

2. Materials Production Aspects

1. Objectives for materials are expressed in a quantifiable manner and specific learning objectives are related to broader programme objectives and to overall goals.	1. Objectives are generally not stated in terms of learner behaviours, but in terms of what the teacher will do or in terms of the content of the subject matter
2. The broad goals and objectives are systematically reduced to	2. Broad goals are generally the only statements given. Contents

the level of specific student behaviour objectives, and are expressed in terms of observable behaviours which may be quantified.	are developed according to what the writers feel should be included.
3. Tests and other measures are based on the objectives established and are designed to be valid in terms of these objectives. These tests are included as a part of the instructional package.	3. Since objectives are not stated in learner terms, the test times are not related to them, but take the form of sampling the content which has been presented. These tests may be included with the materials or may be left for the teacher to prepare.
4. Frequently more than one medium is used, but on the basis of improving presentational effectiveness in terms of the performance objectives.	4. Generally only one medium is used. If two are used, it is for purposes of redundancy or motivation.
5. ITV is expected to organise and present information which may be most optimally or valuably presented through visual stimuli combined with audio stimuli, such as laboratory experiments, principles and concepts involving motion or change, or the presentation of rare or expensive elements, etc.	5. ITV is based primarily on the presentation of a good teacher called a 'television teacher' whose primary task is to be exactly like an excellent teacher presenting a lecture. As part of the lecture experiments, visual presentations etc., may be presented.

APPENDIX - II

Excerpts From 'Learning From Television: What The Research Says'

a. Do People learn from TV?

1. Given favourable conditions, pupils learn efficiently from ITV.
2. By and large, ITV can more easily be used effectively for primary and secondary school students than for college students.
3. As far as we can say from present evidence, TV can be used

effectively to teach any subject matter where one-way communication will contribute to learning.

b. What have we learned about the efficient use of ITV in a school system?

4. TV is more likely to be an efficient tool of learning if it is planned and organised efficiently.

c. What have we learned about the treatment, situation and pupil variables?

5. There is no evidence to suggest that either visual magnification or large-size screen will improve learning from TV in general.
6. There is sufficient evidence to suggest that colour will improve learning from film or TV.
7. There is no consistent evidence to suggest that either humour or animation significantly contributes to learning from film or TV.
8. Inserting question in a TV programme does not seem to improve learning, but giving the students a rest pause does.
9. The students are likely to acquire the same amount of learning from ITV whether the materials are presented as a lecture, or in an interview, or in a panel discussion.
10. ITV appears to be equally effective with small and large viewing groups.
11. The lack of opportunity for students to raise questions and participate in free discussion would seem to reduce the effectiveness of learning from ITV, particularly if the students are fairly advanced or the material is relatively complicated.
12. Students taught by TV tend to miss the personal teacher-student contact, but there is insufficient evidence to suggest that the lack of such contact will impair learning from ITV.

d. Attitude toward ITV

14. Teachers and pupils are more favourable toward the use of ITV in elementary school than in secondary school and college.
15. Administrators are more likely to be favourable towards ITV than are teachers.
16. Linking ITV is not always correlated with learning from it.

e. Learning from TV vs. Learning from other Media.

17. There appears to be little, if any, difference between learning

from TV and learning from film, if the two media are used the same way.

18. TV and radio have certain advantages over films in flexibility and deliverability.
19. Radio is less expensive than TV; economy of scale usually governs cost comparisons of TV and film.
20. Student response is effectively controlled by programmed methods, regardless of the instructional medium.

Works Cited

Baasel, W.D., "Why PSI? How to Stop Demotivating Students", *Chemical Engineering Education.*, (Spring) (78-82), 1978.

Beckwith, W.F. "Audio-Visual Aids Subcommittee Activities", *Chemical Engineering Education*, (Winter) (46-47), 1977.

Chadivick, C., "Educational Technology: Progress, Prospects and Comparisons", Br. *Journal of Educational Technology,* 4, 80-93, 1973.

Hartley, J. *Strategies for Programmed Instruction: An Educational Technology,* Butterworths, London, 1972.

Hicks, B.L. and Hunka, S.,*The Teacher and the Computer*, W.B. Saunders Co, 1972.

Hopper, R. "To CAI or not to CAI?—that is the question", *International Journal of Mathematics Education and Science and Technology,* 1(4), 1976.

Lamb, R.T.B., *Aids to Modern Teaching: A Short Survey,* Pitman, 1967.

Natarajan, R., "The Role of Informal Techniques in Improving the Effectiveness of Formal Educational Programmes", *Indian Journal of Technical Education.*

Postlethwait, S.N., "Using Science and Technology to Teach Science and Technology", *Engineering Education,* 1984.

Prosser, M.T., "Towards More Effective Evaluation Studies of Educational Media", *British Journal of Educational Technology,* 15(1), 33-42, 1984.

Rainey, G.L., "How to Survive Instructional Innovation", *British Journal of Educational Technology,* 154-157, 1981.

Shacham, M. and Cutlip, M.B. (1981) "Computer-Based Instruction: Is there a Future in Ch Education", *Chemical Engineering Education*, (Spring), 1981.

Simpson, *B*., "Heading for the Ha-Ha", *British Journal of Educational Technology*, 14(1), 19-26, 1983.

Tickton, S.G., (Ed.), *To Improve Learning*, Vol. I, R.R. Bowker Co., New York, 1970.

Trow, W.C., *Teacher and Technology: New Designs for Learning*, Appleton-Century-Crofts, USA, 1963.

9

ROLE OF EDUCATIONAL TECHNOLOGY IN IMPLEMENTING NATIONAL POLICY ON TECHNICAL EDUCATION IN THE POLYTECHNIC SYSTEM

S.A. Balu &
S.D. Patki

Introduction

The major aims of the National Policy on Education (NPE) are to prepare the people of the country to face internal and external challenges and to ensure a balanced development of the country to usher in the 21st century. In this context education has been conceived to imbibe in the people the knowledge, sense of purpose and confidence essential for building a dynamic and cohesive nation and provide its people a better, fuller and more purposeful life. The new thrusts of the NPE have emerged from the active participation and the wisdom of all those interested in, contributing to and benefiting from the technical education system of the country. A discussion on the focus of the future of polytechnic education in the light of the NPE initiatives would enable a proper understanding of the roles of the various components in effective implementation of the policies.

Polytechnic education, since the attainment of Independence has undergone considerable expansion and has also passed through crisis situations. Being responsible for the development of middle level technical manpower and sandwiched between engineering education on the one hand and craftsmen training on the other, the polytechnic system and its products are subjected to a variety of pressures and challenges. In spite of such pressures, the polytechnics, because of their number, location and capabilities, have a great potential for contributing to National Development, especially in technical education, training and transfer of technology. The NPE envisages a variety of expanding roles for the polytechnic system, like Rural Development, women's education, education of weaker sections including the handicapped, entrepreneurship development, continuing education and development of technical manpower for all sectors including the unorganised sectors (Figure 1).

Educational Technology cannot only contribute to the fulfilment of the expanding roles of the polytechnics envisaged in the national education policy in a variety of ways but also enhances the efficiency and effectiveness of the system. This paper considers the past experiences with educational technology and its application, its successes, failures and the ways in which it could optimally contribute to successful implementation of the NPE so far as it relates to polytechnic education.

The NPE and Its Implications for Polytechnic Education

The polytechnic education system has so far been fulfilling the role of providing middle level manpower for the organised industrial sector. Changes in technology and manpower pattern requires polytechnic programmes to be diversified to enable a balanced development and to provide manpower for all sectors organised as well as rural and unorganised sectors. The polytechnic education system in order to maintain its relevance, has also to gear itself to offer programmes in new, improved and emerging technologies. It has also to ensure an important role in bringing about the desired transformation in the rural areas inhabited by 80 per cent of India's population through programmes and projects based in appropriate technologies. The rapid change in technology and the emergence of new disciplines and combinations of technologies will require all technical personnel to be provided with opportunities for continuing education. Lifelong education becomes a must if technical personnel have to keep themselves abreast with changing technology. This would require the polytechnics to offer appropriate programmes both formal and non-formal for continuing education as well as for the education of the rural masses. The NPE initiatives expect that more and more women will engage themselves in productive occupations and contribute to the growth of the national economy. It is therefore, imperative that the polytechnics provide opportunities for women to acquire technical capabilities and to enable them to engage themselves in fruitful occupations. In addition to these, the needs of weaker sections and the physically handicapped, have also to be met by the polytechnic system. For positively contributing to the unorganised sector and to enable a significant portion of the technical manpower to start their own

Figure 1: ANALYSIS OF NATIONAL POLICY INITIATIVES-ROLE OF EDUCATIONAL TECHNOLOGY

POLICY INITIATIVES	TARGET POPULATIONS	ASSESSMENT OF				PROGRAMME/ INSTRUCTION RESOURCE DEV.						MEDIA DEV.		TEACHER PREPARATION AND DEVELOPMENT	DEV. OF TESTING SERVICES		SETTING UP OF TECHNOLOGY BASED PROJECTS
		MANPOWER NEEDS QUANTITATIVE/QUALITATIVE	INDIVIDUAL DEVELOPMENT NEEDS	APTITUDES	TECHNOLOGIES & THEIR LEVELS	FORMAL	NON-FORMAL	INSTITUTIONAL	DISTANCE LEARNING	CONVENTIONAL	MODULAR	MASS MEDIA	OTHERS		NEW	IMPROVEMENT OF EXISTING	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 TECHNICAL MANPOWER FOR ALL SECTORS INCLUDING THE UNORGANISED SECTOR	1.1 SUB PROFESSIONALS/ PROFESSIONALS WITH VERY LITTLE FORMAL TRAINING, ALREADY EMPLOYED IN CONSUMER AND SERVICE SECTIONS LIKE TRANSPORT, COMMUNICATIONS, MARKETS, DISTRIBUTION, BANKING, INSURANCE, PUBLICITY ENTERTAINMENT, OFFICE MANAGEMENT, HEALTH, HOTELIERING, TOURISM LACKING IN ABILITIES, ATTITUDES	●	●	●	●	●	●	●	●	●	●	●	●	●	●		

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	1.2 SCHOOL PASSOUTS TO BE TRAINED FOR FULFILLING THE EMPLOYMENT NEEDS IN THE ABOVE SECTORS	●		●	●	●		●	●	●	●	●	●	●	●		
	1.3 WORK FORCE ENGAGED IN ACTIVITIES MAINLY AGRO-COTTAGE AND CRAFTBASED CHARACTERISED BY INEFFICIENT TOOLS AND IMPLEMENTS	●	●	●	●	●●	●	●●	●●	●	●●	●●	●	●	●		●
2. MIDDLE LEVEL MANPOWER IN EMERGING TECHNOLOGIES	2.1 SCHOOL PASSOUTS HAVING APTITUDES FOR OCCUPATIONS INVOLVING APPLICATIONS OF NEW/IMPROVED EMERGING TECHNOLOGIES	●		●	●	●		●		●	●		●	●	●		
	2.2 WORKING PERSONNEL IN INDUSTRY REQUIRING TRG. IN NEW/IMPROVED EMERGING TECHNOLOGIES.	●	●		●	●	●	●	●	●	●	●	●	●	●		
3. CONTINUING EDUCATION	3.1 WORKING PERSONNEL IN INDUSTRY AT THE CRAFT LEVEL	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	3.2 WORKING PERSONNEL IN INDUSTRY AT THE TECHNICIAN LEVEL	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	3.3 UNEMPLOYED SCHOOL PASSOUTS	●		●	●	●	●	●	●	●	●	●	●	●	●		
4 EDUCATION OF WOMEN TRG. FOR PRODUCTIVE OCCUPATIONS	4.1 WOMEN IN RURAL AREAS			●	●	●	●●	●	●●	●	●●	●●	●	●●	●	●	●
	4.2 WOMEN IN URBAN AREAS			●	●	●	●●	●	●	●	●●	●	●	●	●	●	●
5 EDUCATION OF WEAKER SECTIONS	5.1 WEAKER SECTIONS		●	●●	●	●	●	●	●●	●	●●	●	●●	●		●	
6 THE HANDI-CAPPED	6.1 THE PHYSICALLY HANDICAPPED		●	●●	●	●	●	●	●	●	●●	●	●●	●	●	●	
7 RURAL	7.1 AS IN 1.3 ABOVE	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
	7.2 THE UNEMPLOYED HIGH-SCHOOL DROPOUTS		●	●	●	●	●●		●●		●●	●●	●	●	●		●
8 ENTREPRENEUR-SHIP DEVELOPMENT	8.1 ALL POPULATION UNDERGOING TECHNICAL EDUCATION	●●	●	●●	●	●	●	●●	●	●●	●	●	●●	●	●		●●

industries, entrepreneurship development is yet another area where the polytechnics have a significant role to play.

The foregoing discussion shows that the polytechnics have to cater to a variety of target populations. As these populations are located in widely spread areas both rural and urban and belong to diverse age groups and levels the programmes have to be offered in a variety of modes to enable learning in different settings, during different time periods. Such programmes will have to be designed for meeting diverse aims. This requires the development of a variety of institutions and resources, teaching and learning strategies, methods and techniques and the offering of multiple programmes. (Figure 2)

'Education' and 'Educational Technology'—Definitions and Boundaries

The term education is defined in a variety of ways, each one appropriate to the context to which it applied. Education has been conceived as a process of individual development at the micro level catering to national development at the macro level. It aims to develop and cultivate the various physical, mental, social, emotional and moral powers of an individual. In the wider sense education aims at the preparation for life or life-long education. All definitions of education accept a basic feature that it is the process of teaching and learning through which an individual achieves desired objectives i.e., changes his behaviour from entering behaviour to the desired terminal behaviour. This feature of education is the one accepted by All India Association for Educational Technology (XVII Annual Conference of AIAET 1984).

Technology is the process of creatively applying certain known and tested principles (science) to a given practical purpose (or problems). Thus technology is application of the scientific methods to practical situations (Romiszowski 1981).

Just as education, educational technology is also defined in a variety of ways. On the one hand there are narrow definitions to design and develop audio visual aids and educational materials, their use and evaluation. On the other hand there are broad and comprehensive definitions which encompass education in its totality (Rowntree 1971). A proper delineation of its boundaries is essential for appreciation of the role of educational technology in contributing to successful

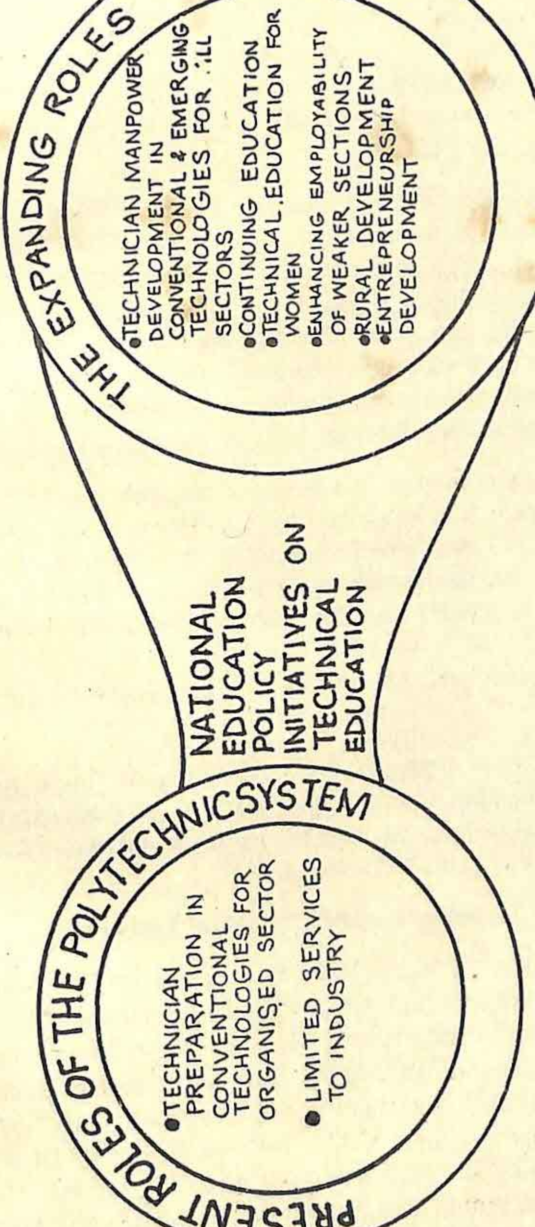
PRESENT ROLES OF THE POLYTECHNIC SYSTEM
TECHNICIAN PREPARATION IN CONVENTIONAL TECHNOLOGIES FOR ORGANISED SECTOR
LIMITED SERVICES TO INDUSTRY
NATIONAL EDUCATION POLICY INITIATIVES ON TECHNICAL EDUCATION
THE EXPANDING ROLES
TECHNICIAN MANPOWER DEVELOPMENT IN CONVENTIONAL & EMERGING TECHNOLOGIES FOR ALL SECTORS
CONTINUING EDUCATION
TECHNICAL EDUCATION FOR WOMEN
ENHANCING EMPLOYABILITY OF WEAKER SECTIONS
RURAL DEVELOPMENT
ENTREPRENEURSHIP DEVELOPMENT

Figure 2: Expanding Roles of Polytechnics

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implementation of emerging national policies. As per the pragmatic definition suggested during the last AIAET conference (1984) Educational Technology is an approach to study, improve, innovate education-teaching learning process, so that an individual or group of individuals achieve the desired objectives more efficiently and effectively. The word efficiency is related to time and cost/resource utilised in the process and effectiveness to the quality and level of accomplishment of objectives.

A more comprehensive definition adopted by the Association for Educational Communication and Technology (AECT 1977) considers Educational Technology as a complex, integrated process involving people, procedures, ideas, devices and organisation for analysing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of human learning. Such comprehensive definitions of educational technology require one to search and ensure the following:

(i) A greater precision in the framing of educational objectives.
(ii) Greater provision based on empirical research and analysis in defining and specifying the means of attaining these objectives.
(iii) Development of materials and processes in an optimal manner to achieve maximum possible efficiency and effectiveness of instruction.
(iv) Creation of suitable physical and psychological environment for learning.

We would now approach the formulation of future roles of educational technology through consideration of past experiences within the country and abroad, their successes and failures, and the new thrusts required due to the NPE initiatives.

Experiences with Application of Educational Technology

We have a variety of experiences at different levels namely the classroom, the institution, the state, regional, national and international levels. It would be our endeavour to discuss a few outstanding examples from the point of view of learning from their successes and failures. By and large polytechnic programmes in our country are centralised at the State level. This excludes a few isolated causes of individual polytechnics having academic autonomy designing and offering their own programmes. Within a centralised framework any effort made by an individual teacher in the classroom in the development of audio-visual aids or print material for the exclusive use of his or her students has limited influence on the system, unless efforts are made for their dissemination and institutionalisation. Evidence of such innovative efforts by such individual teachers exists, but in few cases. Even in such cases a systematic approach to their review, improvement, dissemination, encouragement and reward or a mechanism for implementing such an approach rarely exists. Approaches have therefore, to be conceived within a broad framework, at state, regional or national levels.

Systematic experiments in the application of educational technology to the design, development, implementation and evaluation of polytechnic programmes have been conducted by the four Regional Technical Teachers' Training Institutes. One such major experiment conducted by the TTTI at Bhopal covers the Western Region and is a valuable experience in the application of educational technology.

Bhopal Experiment

The Bhopal experiment was a multi-pronged one and considered educational technology as synonymous with the application of systems approach to educational planning, implementation and evaluation. This model of the application of educational technology included identification of needs, formulation of objectives, organisation of content, development of learning resources including human and physical, quality control through scientifically designed tests and examinations and refinement of all the stages through formative and summative review process. A diagram indicating the model adopted and depicting the inter-relationship between the various elements is given in Figure 3.

Identification of Needs: In the late '60s and early '70s there was severe criticism of technician education by the industry. This criticism was vague in nature and did not point out shortcomings of the product in a precise way. It, however, established the fact that those who had passed out from the polytechnic did not satisfy the needs of the industry. But the steps needed to ensure the matching of needs with the curriculum were not clear. A scientific study for identifying needs, therefore became necessary. This was undertaken through two surveys as follows:

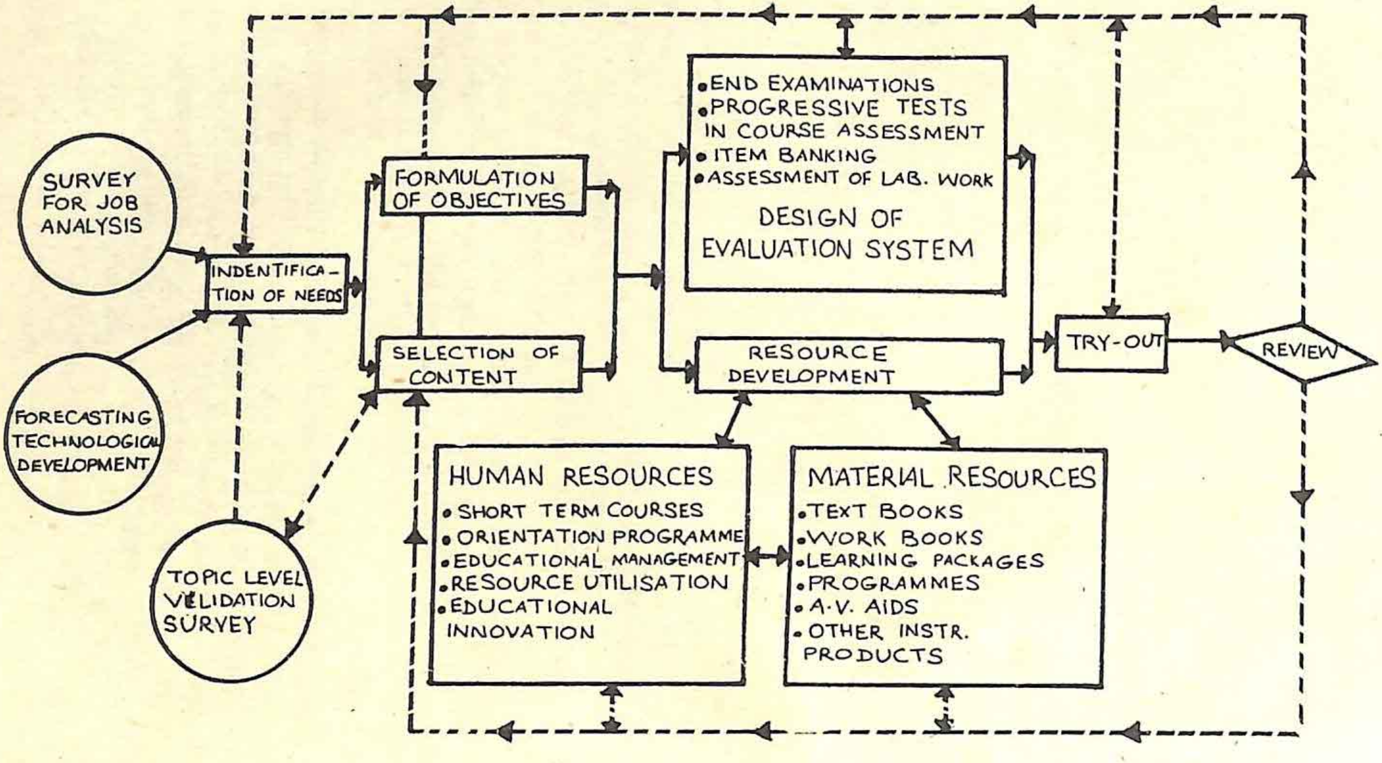

Figure 3: Application of Educational Technology to Curriculum Development for Polytechnic Education

1. Survey for job analysis: The survey covered 1500 working technicians and their immediate superiors, from small industries, large industries, public sectors, utility services and self-employed technicians. The results of the survey were validated by professional engineers. The outcome of the survey was:

1. the job descriptions for fifteen categories of technicians.
2. the functions of some specialised technicians.
3. the high priority functions for which the polytechnics were not providing proper training.
4. a basis for organising and sequencing the content.

2. Topic level validation survey: This was done through questionnaires for twenty special subjects to ascertain the level at which a technician uses his knowledge in a topic. The topics requiring competence of problem-solving were identified. This survey yielded very important data for detailed content analysis.

Curriculum Detailing: Teacher participation of a very high degree was adopted for drafting curricula of the different subjects in terms of behavioural objectives derived on the basis of job functions and topic levels identified. The teacher involvement on a large scale ensured their commitment for successful implementation, in addition to improving teacher competence.

Curriculum Implementation: The new curriculum was first tried in two pilot polytechnics of the State of Madhya Pradesh and after necessary modifications on the basis of feedback the new curriculum was implemented initially in all the polytechnics of M.P. and then extended to the State of Gujarat with some changes appropriate to that state. For successful implementation a multi-pronged approach was adopted, which included the following :

a) Human Resource Development—through, regular teacher training courses leading to a diploma, short courses, orientation courses, constant updating courses and Educational Management courses.
b) Material Resources Development: All instructional materials were developed by groups of teachers and tried out on students.

The variety of materials produced included:

1. Textbooks

2. Workbooks
3. Learning Packages
4. Media like slides, transparencies, charts etc.
5. Laboratory manuals.

Planned Change: To ensure successful implementation a planned change strategy was adopted under which each institution decided its priorities of development and worked in that direction. In order to internalise the innovations selected, teachers from each polytechnic were trained as change agents.

Examination Reforms: Systematic efforts were made to introduce examination reforms like :

1. Progressive assessment scheme
2. Objective tests based on specifications
3. Systematic assessment of laboratory work
4. Establishment of Item Book.

Item Bank: This was yet another major development. Scientific procedures were adopted which consisted of writing and editing items. Compilation of tests to match the specification tables, pretesting on students, conducting item analysis, reviewing the items, and banking the selected items. The Bank was developed as a major resource for objective testing and examinations.

Role of Industry: Throughout the curriculum development process interaction with the industry and its participation was at a high level. Various facets of industry participation are indicated in Figure 4.

Curriculum Evaluation: This whole project was subjected to critical evaluation following scientifically established procedures, which extended over a period of two years. Curriculum Evaluation for M.P. and Gujarat were done separately. The valuable feedback obtained from these exercises has been used to modify various components of the system.

Accomplishments: The major accomplishments of this experiment are in the commitment of a large number of teachers to this approach because of their participation in the development process. This commitment has led to the institutionalisation of the results of this project.

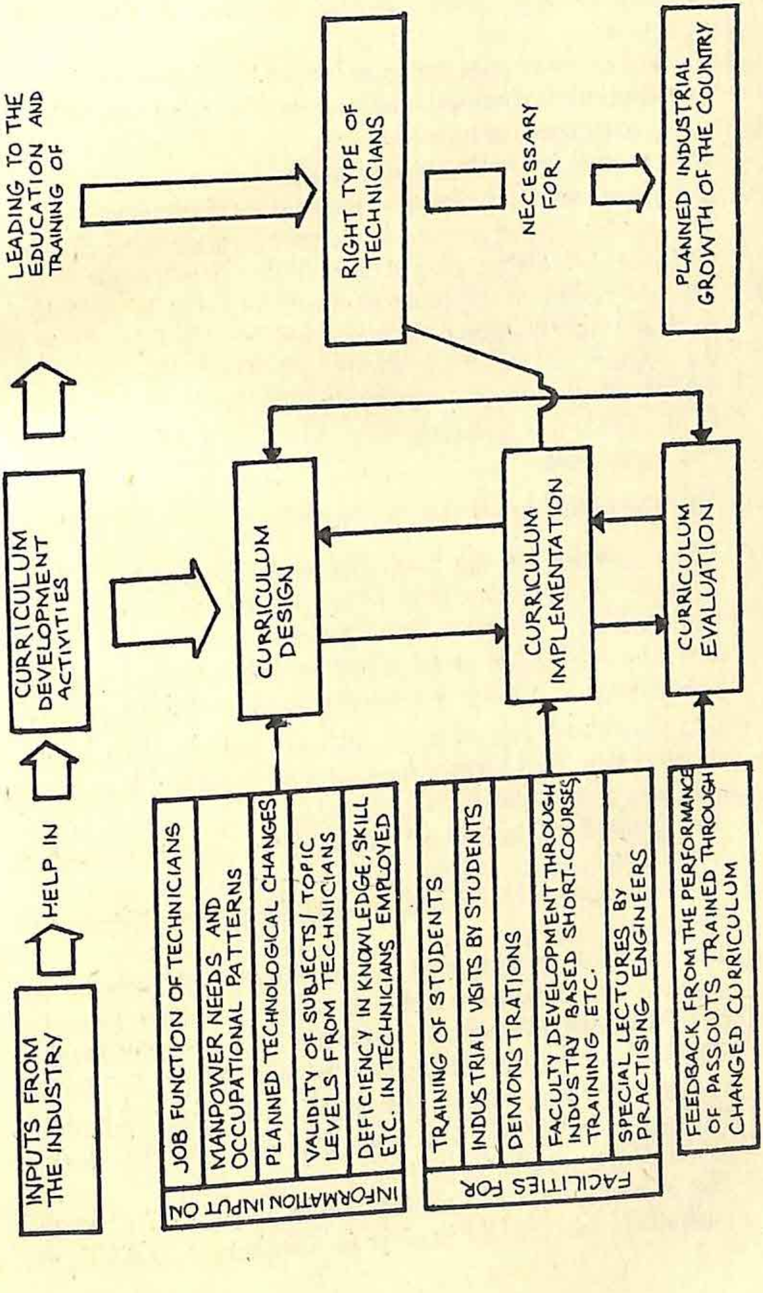
INPUTS FROM THE INDUSTRY
HELP IN
CURRICULUM DEVELOPMENT ACTIVITIES
LEADING TO THE EDUCATION AND TRAINING OF
RIGHT TYPE OF TECHNICIANS
NECESSARY FOR
PLANNED INDUSTRIAL GROWTH OF THE COUNTRY
INFORMATION INPUT ON
JOB FUNCTION OF TECHNICIANS
MANPOWER NEEDS AND OCCUPATIONAL PATTERNS
PLANNED TECHNOLOGICAL CHANGES
VALIDITY OF SUBJECTS/ TOPIC LEVELS FROM TECHNICIANS
DEFICIENCY IN KNOWLEDGE, SKILL ETC. IN TECHNICIANS EMPLOYED
CURRICULUM DESIGN
FACILITIES FOR
TRAINING OF STUDENTS
INDUSTRIAL VISITS BY STUDENTS
DEMONSTRATIONS
FACULTY DEVELOPMENT THROUGH INDUSTRY BASED SHORT-COURSES TRAINING ETC.
SPECIAL LECTURES BY PRACTISING ENGINEERS
CURRICULUM IMPLEMENTATION
FEEDBACK FROM THE PERFORMANCE OF PASSOUTS TRAINED THROUGH CHANGED CURRICULUM
CURRICULUM EVALUATION

Figure 4: Interaction with Industry

1. Development of expertise in a large number of teachers.
2. Detailing of need based curricula in terms of behavioural objectives.
3. The production of print materials for use by students.
4. The preparation of non-print instructional materials for teachers.
5. The establishment of Item Bank.
6. More reliable and valid examinations.
7. The introduction of a system of progressive assessment.
8. The positive student reaction to the reforms ascertained through the curriculum evaluation and other studies in this regard.
9. An appreciation of the rather unsatisfactory state of laboratory work and student assessment in polytechnics and recognition of the urgency of launching efforts to improve the same. The subsequent projects on Engineering Experimentation (Jain P.C. *et al* . 1985) and Comprehensive Assessment are offshoots of this experiment.

Limitation: The following are certain limitations:

1. Much attention has not been paid to the development of the students attitude which is necessary for satisfactory job performance.
2. The implementation of curricula requires refinement in the instructional processes. A sufficient number of teachers could not be trained for ensuring such refinement. The faculty development need became more and more critical because of staff shortages in polytechnics.
3. The centralised system of polytechnic education hinders innovations.
4. The experiment was undertaken under the severe constraints of resources.
5. The tendency to slide back to the original situation in the absence of sustained efforts through continued training, dissemination and research by each of the elements enumerated above. The acquisition of expertise by new teachers joining the system is not an automatic process, nor does it happen through informal interaction with the teachers involved in the development of this experiment.
6. The resource flow and administrative policy support to the institutions does not take place at the level conceived during the

design and development process. The prevailing staff-student ratio is much lower than desired mainly due to the 30 per cent vacancies in polytechnics. The percentage of teachers acquiring training, educational expertise either in their own location or within the training institutions is rather low mainly because of the polytechnics' inability to spare teachers for training for a long duration. The actual requirement and the funding for educational hardware and software were not adequately met.

Innovations in Teacher Training: The limitations related to teacher shortage and the need for improving instructional processes led to the search for alternative avenues for teacher training. One major innovation in this field is the application of CBTE to technical teacher training (Saran & Chandran 1979). Experiments to provide teacher training at the teachers' own institutes and induction programme for new teachers were also successful (TTTI 1981).

UNDP Aided Project at the National Level

The national level project covering all the polytechnics in the country, and designed and implemented jointly by the four Technical Teachers' Training Institutes, with assistance from the UNDP, is yet another example of the application of educational technology to the polytechnic system. The major objectives of the first phase of this project were:

(i) to develop multi-media student centred instructional packages, low cost textbooks and workbooks;
(ii) to produce educational films suitable for polytechnic education;
(iii) to establish a national testing service and regional testing services to implement examination reforms;
(iv) to initiate research programmes on problems of polytechnic education in the area of resource utilisation, teaching/learning processes, educational management and curriculum evaluation.

Accomplishments: The following are the major gains from this project to the four TTTIs and to the polytechnic system in the country:

1. The need for Educational Research for planning, development, formative and summative evaluation of programmes and policies is now widely appreciated within the polytechnic system. The TTTIs are now engaged in a variety of studies to support such areas.

2. The need for educational films appropriate to the country's level of technologies and context has been appreciated. Such expertise for film and video production has been developed within the TTTIs. This has resulted in the production, try out and review of films, and video programmes on a sustained and systematic basis. The potential of these resources for use as mass media in Distance Learning has now been recognised.
3. Quite a number of polytechnic teachers and students have now realised the usefulness of multi-media learning packages in the teaching of technology based topics. There is an increasing demand for such packages.
4. The item bank has been enriched with potential for contributing to the development of tests and examinations and as a major resource for a National Testing Service. There are demands from a variety of recruiting agencies and examining bodies for the use of facilities developed within this area including the item bank and the necessary computer facilities.

The Limitation of this Project: The first phase of this project is just beginning to fulfil the educational resources—demands of the polytechnic system of the whole country. The efforts, therefore, have led to more preparation of resources developed in an integrated manner. Because of the diverse needs of the different States and the different regions and geographical locations a uniform national approach is not possible. During the second phase of the project attempts are envisaged to fulfil the needs of each State within the region in a more coordinated manner, avoiding duplication of efforts and catering to the specific needs of the States.

1. Expertise gained through international programmes:
   Organised approach for the application of the expertise gained through fellowships abroad by TTTI and polytechnic faculty is limited to a few innovations within the country. The dissemination and multiplier effect of such expertise has to be ensured through systematic follow-up programmes.
2. Coordination between the TTTIs for various activities under the project was difficult due to large geographical distances.
3. The problem of adjustment of instructional priorities with the project priorities could not be fully overcome.

Experiences from Other Systems

There are instances of many gainful applications of Educational Technology in other systems of education, from which we can learn and build further upon these experiences. One such major experiment was Satellite Instructional Television Experiment (SITE).

SITE Project: The first experiment of using television for mass education in areas like health, hygiene, nutrition and innovations in agriculture through a satellite lasted for one year (1975-1976). It beamed programmes to 2330 villages in 20 districts spread over six States, and reached a rural population of about 3.5 million. The enthusiasm, experience and confidence this project has generated in rural masses, educationists, engineers and software producers has outweighed the expenses of about Rs.100 million. Encouraged by the impact of SITE the instructional programmes were continued through terrestrial transmission stations.

Accomplishments: Instructional Programmes beamed via the satellite were preferred to entertainment programme.

1. Substantial gains were possible in the areas of health, hygiene and nutrition especially with women viewers.
2. This experiment has proved that community viewing is possible, the average audience size being around 60.
3. The fears that it would not be possible to operate and maintain Direct Reception System (DRS) in remote rural areas were proved wrong.
4. SITE established that the extension of communications infrastructure to remote areas is not only feasible and desirable but it can contribute concretely to promoting national development.

Limitations: Despite case studies of innovations adopted in agriculture as a result of TV programmes a large scale survey did not show statistically significant gains.

Possible Applications of Educational Television (ETV) to Polytechnic Education

With the expansion of TV network in recent years educational television has come to stay in India. School and University education system has already started using Doordarshan network through INSAT-

1B. Polytechnic education system is gearing itself to use this mass media. TTTI Bhopal has already completed several educational video programmes and films which have been telecast and tried out successfully on the students of Polytechnics. Other TTTIs are also doing considerable work in this direction. This mass media being an audio visual combination can contribute significantly to quality improvement of the existing polytechnic courses, and in imparting technical education through distance learning mode in addition to helping the rural and community development projects undertaken by polytechnics all over the country. ETV has a potential not only of sustaining successful 'Green' or 'White' revolutions but also can bring about 'Integrated Development' revolution throughout the country so vital for ushering in the 21st century with a 'big leap forward'.

Educational Television - USA: Professor Wilbur Schram, Director of the Institute for Communication Research at Stanford University analysed 393 separate enquiries into ETV at different levels in schools and colleges, over a number of subject areas. His findings were that in 21 per cent cases—ETV was found to be significantly superior to normal face-to-face instruction, in 65 per cent cases there was no significant difference and only 14 per cent of the comparisons yielded inferior results for television. This study especially showed more positive results for science and mathematics, where only 11 per cent results were inferior. This shows that ETV has a tremendous potential for polytechnic education as the approach to instruction in science and mathematics has much in common with instruction in technology.

The Use of Radio in Education: Today radio stations in all the States broadcast educational programmes for schools. The potential of this powerful media is not yet explored by the polytechnic education system. This especially can be very useful for adult education and transfer of technology for rural development.

Implementation of NPE in Polytechnic Education

The policy initiatives which require expansion/addition in the roles of the polytechnics would necessitate catering to the needs of diverse target populations. Hitherto the polytechnic system has been mainly catering to the needs of those who have done High School, and developing in them the capabilities required for functioning as middle level technical manpower in the organised sector.

An analysis has been made indicating the diverse target populations to which the polytechnic system will have to cater in view of its role expansion. This analysis, given in the form of a matrix (Figure 1), also depicts the role of educational technology in the implementation of the NPE. It would be seen that there is lot of overlap in the roles relating to different target populations. However, the roles, broadly stated will vary depending upon the nature of the target population, for example, the nature of needs of personnel employed in consumer and service sectors will considerably differ from those of the work force engaged in activities within unorganised sector, especially in rural areas. The type of resource needed, the forms and modes of programmes, the delivery systems and the media, the competence required of teachers etc., will differ although the broad role might be the same. The roles related to educational technology which need urgent attention, if policy initiatives are to be met with a reasonable degree of success, are clubbed together under six major areas and are discussed here :

Assessment of Needs

This would encompass assessment of qualitative as well as quantitative manpower needs of target population, the individual development needs, the attitudes required for different occupations and the nature of technology and the level at which training in technology should be imparted. This would need a variety of research studies to be undertaken.

Type of Programme—Their Design and Resource Development

Programmes to be offered will differ in their form and mode. In the majority of the cases both formal and non-formal, programmes will be required. Instruction will be either institutional or through distance learning. There will be a shift from conventional to modular patterns. Looking to the nature and size of the target populations and the rather high percentage of learners who would be in locations away from the instructors distance learning will have to be promoted at a fast pace. Similarly instruction through modules would be more widely used especially in continuing education, education of weaker sections, etc.

Media Development

Media could be categorised, broadly as Mass Media and others which would include A.V. aids and other printed materials mainly for use in

Institution-based instruction. The quantum of the additional target populations would demand the use of mass media in an extensive manner, especially in non-formal education and distance learning.

Teacher Preparation and Development

The number of teachers required for the implementation of the variety of new initiatives has not been precisely estimated, in this paper. However, it would be evident that the number would be much higher than that existing within the polytechnic system. It has been recognised that the polytechnic system, even at present, is functioning with only about 70 per cent of the bare minimum strength needed by the system.

This is, therefore, a major problem to be considered at the initial stage itself. In the absence of adequate number of teachers possessing the minimum basic competencies, the policies relating to any of the target populations cannot meet with any amount of success. Teacher preparation and development, therefore, becomes very crucial for the polytechnic system to plan and implement the policy initiative.

Testing Services

Although attempts have been made to improve the testing services it has to be realised that only a fringe of the problem has so far been tackled. With the addition of new and emerging technologies and also a variety of appropriate technologies there would be large number of occupations for which appropriate tests will have to be developed. This is another area where systematic research will have to be undertaken for developing standardised tests and testing procedures.

Setting-up of Projects

In order to bring about change and transformation of identified populations, especially involving transfer of technology, the setting up of projects with timebound objectives becomes essential. In the treatment of some of the target populations therefore, project planning, implementation and review have to be undertaken.

Action Initiatives Needed

Need for a Leap Forward

The advancement in Educational Technology within the country is a result partly of transfer of expertise from abroad and partly due to innovative adaptation developed within the country. So far the trend has been to gradually emulate and adapt examples of the developed countries. With this process the country would always be trailing behind the highly developed countries. It is therefore, necessary that considerable advancement is accomplished within a shorter time span so that the expertise in the country matches those in any of the advanced countries. Selective planning in terms of acquisition of expertise from more advanced countries, is therefore essential.

Promoting Multiplier Effects and Experimentation

There are institutions essentially meant for research and development in technologies like the Indian Institute of Technology and other institutions capable of developing and researching new and emerging technologies. The major problem is the process of transfer of technology to target population who would benefit from the application of technology. This process of transfer, as has been elucidated earlier requires the application of Educational Technology in a variety of ways. The country is now in a position where expertise in educational technology of a high degree is available within the country although this might be limited to a few individuals in a few institutions. The Technical Teacher's Training Institutes through their efforts and experiments in the past years have gained considerable insight into this process although more in-depth studies, experiments and innovative efforts will have to be undertaken. In order to ensure multiplier effects of the expertise available and the successful experimentation on wider populations, infrastructures available within the TTTIs will have to be appropriately expanded.

Research, Development and Innovations in Transfer of Technology to Rural Masses

The major thrusts in contributing to the development of the rural masses through transfer of technology to the rural community requires a variety of adaptations not only in techniques but also in the process. Well planned innovative experiments applying appropriate educational technology, in this venture rather than adoption of techniques and processes which might have been successful in other settings is therefore essential. The institutions which are at present highly involved in this process or those which have to be established should therefore have structures for research, development and innovations in appropriate educational technology.

Creation of a Network of Resource Centres

In view of the expanding roles of the polytechnic system, it is possible that some of the leading polytechnics and other new institutions to be established specially for undertaking the additional roles would initiate innovative efforts. Unless proper coordination and integration is ensured, such efforts might result in duplication and some gaps. In order to safeguard against the above it is necessary that the resource centres, including learning resource centres already established and those to be established, are brought under an efficient network with the TTTIs performing the function of coordination and integration.

Creation of Agencies to Accomplish Major Roles

Continuing education, Promotion of education, programmes for the women, weaker sections and the handicapped, entrepreneurship development contribution to integrated rural development, community development, technology transfer being the major additional roles for the polytechnic system, agencies will have to be created at all levels within the country through horizontal and vertical linkages. In the absence of such linkages a lot of duplication in efforts and roles could lower the efficiency of the system.

Resource Inputs to Polytechnics

What is the level of resource available in an average polytechnic in the country and what is the expectation from such institutions in terms of performance of multiple roles? The answers to those two questions would expose a wide gap. Over the years, the marginal additional inputs made available to most of the polytechnics, established nearly two decades ago, have not made any appreciable change in their resource levels and facilities. It is becoming more and more difficult for the polytechnic faculty to appreciate that educational technology would improve the efficiency and effectiveness of individuals within the system, and the system as a whole. This is because of the absence of even the minimal facilities for applying or trying out educational technology. This results in educational technology being considered as pragmatic, unimplementable in the average polytechnic setting and requiring more time and energy of individuals. The priority action needed is to create conditions and infrastructures that would facilitate the transfer of educational technology to the average polytechnic setting. There is therefore, a priority need to improve the resource levels in polytechnics to facilitate application.

At the same time, the problem of low resources itself could be tackled through innovations applying educational technology. The notion that educational technology needs costly equipment and is therefore costlier than conventional methods is not totally true. Television could be effectively used in situations where institutions face inadequacy of equipment and have no funds to procure the same. Very effective demonstrations could be made using television as the next best substitute for the equipment or machinery. This could definitely be more effective than any other method through which knowledge could be imparted. The use of television as mass media is yet another example through which per capita instructional expenses could be reduced by preparing programmes in the development of which effective teachers of the concerned subject matter and educational technologists in that field are involved. Although these may not be appropriate for all technologies, there are definitely a number of fields where mass media could be effectively utilised. The myth that the application of educational technology is always expensive and entails high unit costs has to be disproved. In providing additional resources inputs to polytechnics this is a major aspect which could be considered so that plenty of resource concerning mass media as well as resources needed for other types of media is made available to the polytechnic education system.

Interaction with Industry

Industry being the major user system of the products of polytechnic education, the NPE has emphasised the need for promoting interaction with industry in the various facets of polytechnic education, namely, programme design, implementation and evaluation. These could include areas like resource sharing, sharing of expertise, exchange of personnel, staff development, identification of problems in industry, problem-solving, training of students as well as teachers in industry, development of tests and examinations, and continuing education of working personnel in industry. Encouragement to specific institutions as well as industry in the operation of sandwich programmes, institutions to be adopted by industry is also envisaged. All these efforts will require specific studies to be carried out at institutional, state, regional and national levels for setting up of new programmes and projects. Educational technology, in so far as it relates to the conduct of scientific studies, as well as in the efficient and effective organisation and implementation of such programmes, and project based on improved interaction with industry has a major role to play (Figure 4).

Conclusion

Educational Technology for polytechnic education has to be conceived as a national movement. The NPE initiatives expect the polytechnics to perform a variety of additional and major roles. Educational technology has to be understood as an approach which will enhance the accomplishment of objectives and improve efficiency and quality. For this to happen, research, innovation and experimentation has to be promoted at all levels, new infrastructures created and coordination and integration ensured at all levels. By far the most important, the polytechnic resource levels have to be augmented to ensure application of educational technology in the implementation process.

Works Cited

AECT, *The Definition of Educational Technology,* Association for Educational Communications and Technology, USA, 1977.

Han Cock, *A Planning for ETV, A Handbook of Educational Television,* Longman Group Ltd. London, 1973.

Jain P.C. and Kargasthala, V.G., "Engineering Experimentation Course: An Integrated and Interdisciplinary Approach to Laboratory Instruction"—*International Journal Applied Engineering Education,* Vol. 1, No. 2, 1985.

Kulkarni, S.S., "What is E.T. in IAET?" XVII Annual Conference, 1984.

Ministry of Education, Government of India, *Challenge of Education—a Policy Perspective,* 1985.

Romiszowski A.J., "Trouble shooting in Educational Technology or why projects fail." *PLET,* Vol. 18, No. 3, August, 1981.

Rowntree D., *Educational Technology in Curriculum Development,* Harper and Row, London, 1971.

Saran Y., *Reorganisation of Polytechnic Education in India—Bhopal Experiment,* International Conference on Technical and Vocational Education Denver, USA, UNESCO, 1976.

Saran, Y. and Chandran, G.S., *CBTE AT TTTI Bhopal - A Case Study— An Innovation in Teacher Education, TTTI*, Bhopal, 1979.

Schramm, W., *Television in the Lives of our Children*, Stanford University Institute of Communication Research, Stanford University Press, 1961.

Sengupta, B., Report of the Government of India - UNDP - UNESCO Evaluation/Appraisal Mission on Project 'Curriculum Development of Technician Education', Ministry of Education, New Delhi, 1981

TTTI, *Curriculum Evaluation Project Final Report*, TTTI Bhopal, 1977.

Mukhopadhyay, M et al., *Polytechnic Curriculum Evaluation Project, Gujarat*, TTTI Bhopal, 1981.

Mukhopadhyay, M. et al., *Alternative Models of Teacher Training*, TTTI Bhopal, 1981.

10

INSTRUCTIONAL TECHNOLOGY FOR MEDICAL EDUCATION

Dr. A. Krishna Rao

U.G. and P.G. Medical Education

With the rapid expansion of medical colleges from 34 in 1953 to about 130 today, there is a great dearth of qualified teachers to fill the posts in the different departments especially in the non-clinical subjects. The usage of instructional technology in medical education of the undergraduate is minimal (approximately 1% of the instruction). Good teachers are a scarce commodity. We should find better methods to display this talent of the scarce and valuable faculty.

Advantages to Faculty : Multi-media instructional materials can enrich, supplement and complement the teacher and relieve him of the monotony of repetitious teaching.

Advantages to the student : With the availability of the variety of instructional materials the student will play a more active part in his own education. The student can be offered more flexibility in the choice of courses, as he can be offered courses for which faculty are present in another institution. Another distinct advantage is, he can be offered a variety of instructional materials to achieve the same instructional objectives.

The following description of a course run by Prof. Arthur Luerhman gives an idea of what is meant by variety of instructional modes to achieve the same instructional objectives.

In the description of Physics 13 written for his students at Dartmouth, Prof. Arthur Luerhman indicated that for each student unit there was a study guide which gave information on which reference material could be found in their own textbook, in a film loop that could be run on a projector in 220 Wilder, or an audio cassette mini lecture or a video-tape lecture or demonstration, a computer programme or a laboratory. Different students have different styles of learning, and were offered many routes that led to the objectives stated in the study guide.

The document also advised students that another Physics course with equivalent content, would be taught in the conventional lecture mode simultaneously by another professor.

If they decided that Physics 2 was not suitable they could transfer to Physics 3.

Will technology mean impersonality in instruction? The purpose of teaching is to help a student to learn. Dr. Miller in a study of teaching learning situation in the medical colleges concludes that many a time, instead of the teacher helping the student to learn, he actually comes in the way of his learning. Moreover how much student-teacher interaction is there at a personal level? There are certain advantages in using a machine especially in a heterogenous country like ours where individuals from different castes and different socio-economic backgrounds meet in the classroom. David Riesman observes:

> A machine is not a sadist and does not suffer from rebuffs or redundancy. Nor does a student feel demeaned by having to take instruction from a person of another class or race or sex. For a boy who feels that, like Huckleberry Finn, or for a black student who feels that a white teacher is subjecting him to counterfeit nurturance and thus making him even weaker and more deprived, or for a lower class white student who feels a similar uneasiness at being helped, the machine can be a marvellously neutral substitute.
>
> Few teachers are sadists; but they are however human and naturally react to the above reactions of students and to the constraints of conventional school organisations. The machine can spare both student and teacher.

Continuing Education

All of us are aware that with the rapid expansion of knowledge, a doctor who passes out of even the best medical college becomes out dated after 5 years if he does not continue to learn.

Are we training the student to continue to learn throughout his life time? A student, by the time he has completed his MBBS course, has to take examinations in about 141 subjects by writing 19 papers, appear for orals and practicals before 56 people! By this the student has been conditioned to learn only by the threat of an examination. Is that the right preparation for a life time of learning? The instructional technology now available will place the burden of seeking out knowledge on the learner and thus prepare her/him better for a life time of learning.

All of us are concerned that the doctor should continue to learn because that will improve the quality of the health care given by him/her.

At most of the CME programmes arranged for the practitioners, the attendance of the practitioners is poor. The programmes are too scattered, too few and very late.

Drayer has spelt out the criteria to be satisfied by any programme of CME.

1. Personal satisfaction
2. Freedom of choice
3. Continuity
4. Accessibility—equal access to all doctors
5. Convenience—means getting what you want, when and where you want it.

Today the TV and video cassette along with other instructional materials offer a unique technology which can satisfy all the criteria—take CME to the very doorstep of the doctor.

As the health professional comes into contact with individuals, he can be used as a fulcrum to propagate health education; teach the health professional to practise preventive medicine.

There are two impediments today for the use of educational technology in the training of the undergraduate or postgraduate or in the continuing education of the health professionals. Firstly, no one knows about the availability of software. There is no place to which he can turn for information and guidance to available software. The second reason is the poor quality and quantity of the software available.

Learning Resource Centre

How do we *remedy* this situation? The remedy lies in developing a bio-medical communication network—a national organisation on the lines of the Lister Hill Centre attached to the National Medical Library in Washington. This central organisation must have 4 or 5 regional centres to start with. The functions of these Learning Resources Centres would be :

1. Prepare a catalogue of all print and non-print media pertinent to all health sciences.
   This must give information about the content, educational objectives, audience level, media, software format, source and availability, running time, cost, author, etc.
2. Storage and retrieval
3. Distribution of the material
4. Development of new materials
5. Evaluation of the materials.

Learning resource centres must utilise and involve the users, the users being the staff, students and practitioners of the health profession, to identify priority areas to develop and evaluate materials. In the development and evaluation of materials besides the academic staff interested in the content areas, an educational technologist and media specialist also must be involved—the educational technologist to help the academic staff to spell out the objectives and to see whether the principles of the psychology of learning are being observed and help them in evaluation; the media specialist to advise the academic staff about the best medium to communicate the message, to help matching the medium and the user.

These learning resource centres must be funded adequately (i) probably about one per cent of the total national expenditure on health education by Governments, (ii) pharmaceutical companies, and (iii) users.

Works Cited

The Fourth Revolution : Instructional Technology in Higher Education—A report and recommendations by the Carnegie Commission on Higher Education, June, 1972.

"Educational Technology for Medicine, Roles of the Lister - Hill Center." Edited by Eugene A Stead *et al* . *Journal of Medical Education*, Vol. 46, July, Part 2, 1971.

Dryer, B.V., "Life-time Learning for Physicians." *Journal of Medical Education*, 37: June, Part 2, 1962.

Miller, G.E., *Teaching and Learning in Medical Schools*, Haward University Press, Cambridge, Massachusetts, 1961.

11

MANAGEMENT : IN SEARCH OF APPROPRIATE PEDAGOGY

Late Nitish R De

Introduction

Let us begin with two elementary points. In the first place, as of today, we have some knowledge and ideas about management, generally in the rest of the world and specifically in India. Similarly, we have a certain quantum of knowledge about educational technologies as applicable to management. In respect of this point I shall not cover what we already know reasonably well.

The second issue is that there is scope for considerable improvement in what we know about management as well as its educational technology. I would like to explore this theme. This should not give the impression that what I intend to share are brand new ideas or elegantly innovative in their content for a brave new organisational world. Without doubt, however, it is high time that we departed from the traditional wisdom and escaped from its futile sterility.

Management

A significant aspect of management is that it covers all types of systems which have to be managed. In other words, I do not accept the proposition that the focus of management is industrial, commercial or service types of industry. Any human system is relevant, whether it is a Rural Health Care Centre or Association of the Girl Guides or a Rotary Club or a Kindergarten or an organisation of the Dalit Panthers.

What is the educational requirement, one may ask, in the management of these diverse human organisations? The significant element is the *managing processes*. When we use the term *managing processes* we refer to an on-going, unfolding and progressing or regressing human organisation. Managing can be compared to the flowing waters of a river, not a cesspool.

The process of management involves four components all in a state of interacting flux. One element is the expanding knowledge about humans, about technologies, about systems and procedures, about the mission of the human system and the interaction amongst them. The second element is acquiring skills to handle and manipulate the various components which are constantly interacting amongst themselves in a social entity—skills to do and undo things. Skill like knowledge is an expanding or contracting phenomenon. The act of expanding or contracting through action or inaction is happening all the time. The third element refers to changing attitudes and behaviour. I use the word 'changing' because barring a limited number of attitudes, in respect of a person, which can assume the character of fixation in the form of biases, prejudices and stereo types, other attitudes are influenceable and as such changeable. Action and reflection, interaction among human agents and influence of environment contribute towards changeable aspects of attitudes.

The fourth element is the context. This is comparatively an unexplored area in the field of management. The context is like a broad canvas of ecology which incorporates all the three elements mentioned above and, in turn, influenced by them.

In other words, management is a learning event, on-going in character, happening formally or informally, in which the four components are dynamically co-existing. It perhaps is more complex, at least that is what I assume, than Wisson's Dark Chamber. Management is dealing with processes many of which are embedded in black boxes.

However, I do not wish to imply that management is a mysterious phenomenon. All that I want to point out is that we are dealing with a complex on-going event because our subject matter which is human organisation is the most complex entity so far devised because its basic constituents are human beings, about whom our understanding is finite and limited.

Educational Technology

What we have said so far means that the educational inputs required for management should be such as to capture the reality of flow. If all the four components of a human system are in a state of dynamic existence then we require technologies which, like a movie camera, can capture the events as an on-going process.

We need technologies which can be likened to Time, which by definition is mobile. Time does not stop.

Given this formulation, I suggest that the relevant educational technology for managing processes is one that can generate learning culture among the members of an organisation who can become agents of positive change as well as the agents of positive learning. Changing and learning imply that educational technology has to foster these dynamics.

I shall touch upon six processes which are being experimented upon with prospects of responding to our needs. The first two are Search Conference Methodology and Conscientisation Process with which names of Eric Trist, Fred Emery and Paul Freire are associated. One may also mention the name of Ivan Illich (De Schooling 1984). Both these methodologies deal with such institutionalising processes as can help liberate human beings from many of their mental shackles, inherited and self-created myths, and consequently aim at their becoming ideal-seeking entities. Both the approaches have certain explicit and implicit common elements as well as some differences, which are illustrated below:

A. Explicit Common Elements that Distinguish the Two Approaches

Search Conference(SC)	**Conscientisation Process(CP)**
1.Futuristic orientation with emphasis on man as ideal-seeking system.	Futuristic orientation with emphasis on 'practice of freedom' as man's destiny.
2.Seeking a productive alternative to type III environment: disturbed reactive, characterised by competition-prone, organisation system and alienated human beings, leading to type IV strategy.	Seeking a viable alternative to massified, dehumanised social system that subsists on dominating culture and 'mythification of reality'. Cultural action is the focus for type III reality whereas cultural revolution for type IV reality.
3.Basic faith in persons: common men who are otherwise treated as 'faceless', inexperienced, uninvolved (e.g. participants	Basic faith in man—the historically ordained victims of 'culture of silence'. (Hence, concern for getting

in the Gungahlin experience).	involved with the poor peasants and the oppressed).
4.Learning as an experience of freedom and understanding of reality (puzzle learning). This will lead to creation of desirable futures through adaptive social planning and action.	Learning as an enriched experience of reality leading to involvement in transformation of reality (action-reflection based change orientation; problematising).
5.Group as a vehicle of search and change (individual orientation negated).	Group as the basis for practical experience—critical consciousness to be internalised by individuals but in a group context.
6.Staff role is not seen as elitist, expertise-based role. They are fellow explorers.	Staff and participants become subjects in exploration of an object.
7.There is an exclusion principle involved in that those who are not oriented towards seeking new ways, new alternatives for human future, are not encouraged to stand in the way of those who want to.	The members of dominating forces who generate and foster the massification culture are not the target of change exploration.
8.Confrontation with reality is emphasised. Simulations or games are seen as diversionary for learning experience.	Learning from day-to-day ongoing themes and their codification and decodification is crucial. Concrete context and theoretical context are inseparable from human experience.
9.Extension as a form of education is rejected. Direct criss-cross communication is preferred. That is why there has been a critical attitude towards TV as a vehicle for education.	Communication is direct, exploration-oriented, dialogical process.

10.The approach oriented towards social system change has set its course against the current of esoteric, quantitative bias; social science research which, according to this approach, counts trees missing the forest—the totality of man in relation to his world is emphasised.	Conscientisation approach takes the man-reality nexus as its focal issue, and numerical configuration which cannot but measure the reality in segments, is discarded.

B. Implicitly Common Elements that are Perceived in the Two Approaches

Search Conference(SC)	**Conscientisation Process(CP)**
1.Apparently the action orientation is not evident in this approach to a point of criticality. However, the participative design which has led to SC has action orientation in democratising a system.	Action orientation is explicitly emphasised. But not activism at the expense of reflection.
2.Emphasis on process in the statement of 'medium is the message' does not reflect the purpose-orientation of SC. Content is equally significant while considering not only the issues, but also the purpose behind the processes moving towards institutional ideals.	Process is a major message in the new pedagogy but the objectives of human liberation (negation of falsified life and living)are in the forefront all the while.
3.Institutional ideals as spelled out by Emery stated in the form of ideal-seeking are explicit.	In Freire, the objectives of liberation and practice of freedom visualise social system arrangements where the ideals that Emery has identified can be anchored.

4.Although futuristic vision is there, the orientation towards the present is not neglected. More explicitly, work-system redesign to debureaucratise and reduction of rigidity of hierarchical formalities are seen as the beginning of the building blocks for designing the future.	Orientation towards the present may be less explicit in CP. In reality it is not so. The emphasis on educational pedagogy to change the present education system is an example of the building block for approaching desirable future. Exploration of existing myths and culture is yet another example.
5. Implicitly, SC modality rejects messianism. No doubt, Fred Emery's pioneering role is acknowledged but others do not feel constrained in their thoughts and actions in pursuing the change strategy utilising their skills and appreciation of realities.	Freire has potentially all the elements of being cannonised. He himself expressed concern about mythification of conscientisation. On the other hand, continuous emphasis on socio-cultural context of an historical epoch or a country ensures the openness of approach negating dogmatism.

(C) Differential Elements in the Two Approaches

Search Conference(SC)	**Conscientisation Process(CP)**
1.The socio-economic context of SC is the first world—UK, Australia, Norway, Sweden—the metropolitan countries with predominantly industrial culture.	The socio-economic context of CP is the third world—the satellite countries where rural economy still dominates.
2.The socio-economic-politico-cultural context of change (transformation of reality) is still to play its appropriate role in SC. Maybe it will emerge as Emery, et al.	The accent is on reality search and identification of the forces that constitute the reality. So, there is unmistakable emphasis on political consciousness and role of

done in the writings of on China.	education.
3.Gradual change may be implicit in both micro-level and macro-level change. Emphasis on the diffusion process in a democratic context where mobilisation is a persuasive voluntary effort.	Cultural change and cultural revolution are dichotomised in the context of social realities. However, cultural action is based on mobilisation principle in a dialogical framework where semi-intransitive consciousness is to lead to critical consciousness for basic structural change. Time element acquired a sense of urgency here. (For details, vide De, 1984).

Basically the message is simple. Learning is a collective process and, therefore, it calls for a methodology which can provide a collective foundation for facilitating learning. The other important element is that learning is an integrative process where there is no sharp distinction between the learners and the teachers. Both are subjects exploring an object.

There is yet another related issue in educational technology which I wish to mention. Managing human organisation is managing human affairs. In this it is possible to create a situation where the danger of messing up the managing processes can be reduced, or hopefully eliminated. For that to happen one cannot depend on professional knowledge alone. Professional knowledge can make a surgeon effective in the operation theatre. That need not deter him from being jealous of a professional colleague or to take advantage of his students to advance his professional career.

Therefore, in search of appropriate educational technology, in addition to knowledge, skills, attitude and contextual thinking, it is necessary to develop an ability to become wise in thought and action. This is the third requirement of educational technology. Being wise or to cultivate wisdom is again a flow process. Wisdom is not a fixed quantum nor is it static. To be wise in thinking and acting in relation to human affairs is to be engaged continuously in a process of helping a person to be constantly in the phase of becoming, a state of unfolding. The spirit of this has been captured by Donald Schon (1983) when he mentioned that reflecting-while-acting is a process where use of intuition in vague and fuzzy situations can take a person to a state of judgement beyond the status of technical rationality. To be wise implies a constant state of intuitive movement of self, individual or collective, to unravel the reality. Being wise, in our view, an essential requirement in the development of educational technology, is to be human in the best sense of the term. Knowledge can tell what we can do, wisdom guides us to what we should do.

"Persons as the end measure" is the crux of cultivating wisdom. Viewed in this context, the managing process will have as its centrepiece the human actors of a social system.

The educational process which may facilitate cultivating the art of being wise requires considerable degree of free space, supportive climate to experiment and opportunity to interact with fellow human beings with little or no defensiveness which can act as a filter. This is a challenge to us—the seekers of purposeful system. We require an approach to develop vision. To be wise is indeed a key requirement for our learning strategy for acquiring vision (M. Emery 1986).

The fourth strategy, interlinked with the first two, refers to action research. Learning is meaningful for installing a purposeful human system if it is put to participative exploration in changing a system. Kurt Lewin opened a new route to learning about, and changing, a system which, despite its vast potential, remains a comparatively neglected approach. The split between thought and emotion, research and action belongs to our mind. The split does not exist in the real world. Action research helps us to appreciate the integrative process of learning rather than narrow-band discipline-based learning. Organisational reality cuts across different types of disciplines and different schools of knowledge and thought. The reality comes alive when, as learning entities, we engage ourselves in organisation change (De. 1985).

Close to what we have mentioned is the learning approach that guides us to accept the proposition that in the managing process we need to understand the principle of multiple causation. This is our fifth requirement. Simple one-to-one causality is invalid in organisational reality. Several causes, interlinked in direct or subtle ways, may contribute to an effect which may also embody several discrete components. We need an open mind in the exploration of reality, keeping in view the basic tenets of scientific inquiry.

The multiplicity of causality make our search more complicated, but hopefully it is not an intractable situation. Artificial intelligence is a growing field arising out of the active interface between the members of a social system and improving models of computers, a live example of hi-technology. The Expert System provides a high level intellectual support for a human expert. The inter-play between the two improves the quality of work, whether it is medical diagnosis or chemical identification or economic geology or structural analysis or organisational effectiveness. Human experts, users of a facility and the computer can collaborate to develop an expert system which can unravel the significance of multiple variables, their inter-relationship, pave the way to install a more effective instrument to solve complex organisational problems and lead to better utilisation of human resources. The evolving expert system results in better man-machine interface where flexibility is built-in for exploring the why, how, and what of our organisational learning (Mumford, 1985).

Conclusion

In the end, I would like to mention that the contemporary crisis in managing our human system of diverse kinds is a deep one. We may turn to the analysis of L.C. Jain *(Grass without Roots; Rural Development under Government Auspices,* New Delhi Sage Publication, 1985) to understand how serious a matter it is that despite millions of rupees being pumped into poverty removal programmes in the rural areas the best that we can claim to have achieved so far is to develop a delivery system or an extension service which has provided grass without roots to the poor. We have been alleviating poverty in India by resorting to more and more fragmented and insulated agencies which have been infected by the virus of in-fighting amongst themselves and in the process getting diverted from their basic purpose which is to eradicate poverty from rural India (De, 1985).

I mention this problem to highlight the point that the managing process is a vital issue that breaks no complacency. We require an approach to make ourselves better actors in managing human affairs unlike what we have achieved so far.

It is a thought that perhaps what we need now is government's participation in people's activities instead of people's participation in Government's activities. To me, without further elaboration, this will perhaps be a suitable starting point for evolving requisite educational technologies for the managers of the system. (De, 1986).

Works Cited

De, *Alternative Designs of Human Organisations,* New Delhi, Sage Publications, 1984.

———"Action Research as an Approach to Faculty Development", *Quality of Work Life,* May-August, 1985.

———"Administrative Innovations for Poverty Alleviation Programme", *Quality of Work Life*, September-December, 1985.

———"Government's Participation in People's Activities", a paper to be presented to an International Conference in Oslo, Norway, in June 1986.

Emery, "Learning to act Wisely", to be published in January-April issue of *Quality of Work Life*, 1986.

Jain, L.C. et al., *Grass without Roots: Rural Development under Government Auspices,* New Delhi, Sage Publications, 1985.

Mumford, "Expert Systems and Organizational Change", *Quality of Work Life*, September-December, 1985.

Schon, *The Reflective Practitioner,* London, M. Temple Smith Limited, 1983.

12

RAISING MANAGEMENT EFFICIENCY THROUGH MODERN TECHNOLOGY

R.P. Singhal

The Revolution

Electronic revolution has already made a far reaching influence on business, industry, space, war, peace and development. What we have seen, however, is only the beginning of the revolution. The fast emerging changes in electronics are going to have a much bigger impact on education, business, industry, office, enterprise and management science than we have so far witnessed. The whole process of communications and information system is expected to undergo a significant change in our country requiring educational planners and managers to give up their age old traditional ways of planning, supervision, monitoring and evaluation and, instead, adopt unconventional means which would not only facilitate their tasks but also quicken the pace of national development.

Soon, the managerial environment and decision making will be transformed with computers doing more and more routine work. The electronic revolution is going to change managerial and social life as did the Industrial Revolution (Papageargion, 1983). Even forecasting will become easier and more accurate due to the emergence of the latest computers and micro processors. These modern gadgets have a wonderful capacity to store, analyse and retrieve data through memory chips.

Computerising Management Processes

When I introduced computers nearly two decades ago for management of a large examination system in the Central Board of Secondary Education, there were apprehensions in the minds of some higher level officers, financial advisers and even people in general about the need and desirability of such computerisation. But, their doubts were removed in no time as the use of computers brought tremendous efficiency, reduced avoidable delays and enabled various innovations to be introduced in the examination system. We could offer to schools and students flexibility in the choice of subjects, standardise the raw scores on a scientific basis and produce substantial data which proved immensely useful for disbursement of scholarships and other awards and provided a sound base for planning of admissions of successful students to various courses in different colleges and institutions of higher learning. Interestingly, the use of computers also proved economic because of a large magnitude of tasks that they handled and many Boards and Universities have since computerised their examination system.

Today, the computers have become inevitable not only in the management of examinations by Boards and Universities, but also in management of accounts, personnel and other information. It is common knowledge that in most States, there is hardly any up-to-date information available about the teachers of various categories. Recruitment of teachers is generally in a backlog as it is not immediately known as to how many teachers are going to retire in the next few months and how many vacancies are likely to occur for different subjects and classes in the schools for the coming academic session. Nor is it possible today to know who has undergone training during the last few years, of what duration and in what subject(s). The staff development today is, thus, more a matter of ad hoc arrangement rather than a systematically planned affair. The State authorities also find it difficult to plan their other activities in a proper manner.

If the required data about all types of schools and colleges can be continuously fed into the computer, the supervisory officers will have quick access to the relevant information which could enable them to take timely decisions.

It is also common knowledge that varying figures of enrolment of pupils in various classes are put forward at different times by educational functionaries and there is hardly any plausible explanation for the variations. Nor is it possible for the authorities to check and control the accuracy of the figures as it is well nigh impossible to manually maintain and monitor the records for a large number of students, teachers and other personnel. Similarly, various programmes and schemes remain unmonitored because it is difficult to keep track of their progress.

Seventh Plan Perspective

Of late, use of new technology for purposes of educational planning and administration has received special attention. This is obvious from the particular thrust that new technology has received in the Seventh Five-Year Plan (1985-90) and the National Policy on Education adopted by the Government of India in 1986. Promotion of efficiency and higher productivity has been a major concern in the preparation of the Seventh Plan. The Plan has recognised that new developments in micro-electronics, informatics, telematics and space technology offer exciting opportunities for modernisation of our systems and increasing productivity. Full advantage is proposed to be taken in future of the advances in science and technology to bring about the structural transformation of our economy. The Policy statement of the Government is a major indicator of the Government's Policy in this regard.

The Seventh Plan states that in the present age, science and technology have to be an essential part of the educational system. Education must ensure that it equips the individual to emerge into a world that is today largely fashioned by science and technology and is in the process of continual change. Education, according to the Plan, would thus need significant restructuring during the Plan period; it must contribute to the development of quality, excellence and leadership. It is essential to work out ways and means whereby highly capable individuals are identified and provided with opportunities for true development.

New Policy Thrusts

The National Policy on Education 1986, visualises the great potential of modern technology to bypass several stages and sequences in the process of development. It states that educational technology will be employed, inter alia, to reach out those who are today not covered by the educational system. It will also be used to spread useful information, to train and retrain teachers and to improve the quality of education.

Even more important is to improve the internal efficiency of the educational system. It is in this context that the policy lays special emphasis on effective management of education. How to make the system work is a major issue to contend with while implementing the new policy. This would require rigorous monitoring and evaluation of all programmes and institutions, enforce a Management Information System which will generate a data base at different levels of educational administration and introduce a planning mechanism which would enable proper decision making for the future. Use of modern technology is one of the surest ways to make headway in this direction.

Priority Areas

The Programme of Action approved by parliament in August 1986 for implementation of the National Policy on Education has identified the following areas which should receive priority:

a) Making the system work;
b) Decentralisation of management, provision of autonomy and establishing accountability of institutions, systems and teachers;
c) Working out details, mechanisms, funding arrangements for the national system of education;
d) Manpower planning and demand forecasting;
e) Media and technology with special reference to Adult Education, Non-formal Education, Open and Continuing Education;
f) Development of a periodic review of curricula and teaching learning processes; and
g) Stengthening of data base; monitoring and evaluation system.

In all the above areas, the role of new technology such as computers, video, TV, radio, audio-cassette, films and mass media cannot be over emphasised.

Management Information System

The implementation of the Education Policy depends to a very large extent on how reliable, effective and quick is our Management Information System. Today, we have nearly half the colleges which are non-viable. New colleges and schools are opened without any consideration of the facts which would justify such opening. It is no wonder that under such circumstances decisions ragarding opening of colleges and schools upgrading of existing ones say from primary school to middle or from middle to secondary school are taken more on political and other extraneous considerations than on bona fide needs. Is it cost effective to open a residential secondary school or college in a particular area rather than opening a chain of small day schools and colleges which are ill-equipped and for which adequate resources cannot be found, is yet another question which has so far not bothered us because there is no adequate data on the basis of which such decisions could be made. Nor do we have at present enough information about what happens to the norms which are prescribed for different kinds of expenditure. For example, the norms of teacher-pupil ratio for schools are not only irrationally fixed by different States but also in actual practice they are observed more in breach than in compliance. There are a large number of schools in different states where teachers are not in position according to the sanctioned strength (Singhal, 1986). Similarly, it is common practice that grants-in-aid are given to institutions in a routine manner year after year regardless of their actual performance. It is unfortunate that in a poor country like India. resources continue to be made available even to those whose output is quite unsatisfactory.

Increased attention has,therefore, to be paid to building appropriate information systems. The interest in a strategic information system is already widespread in some industries, e.g., civil aviation, banking and financial services, hotel reservations, etc. In the late 1980s, the managers of most organisations are likely to be demanding information systems that would enhance their organisations competitive positions. Executives will be judged on how quickly they can get new systems built and installed, how well these systems improve the companies competitive performances (Ralph and Barbara Jr.,1986). The system of education can ill afford to be oblivious of such developments and changing needs. If we have really to go in for improving our efficiency in planning and management of the education system, there is no alternative but to build a strong information system at all levels. With the policy of decentralised planning and administration that we have now adopted in our country, management information system (MIS) assumes still greater importance.

Long Range Planning

No nation can sustain itself by merely looking at the past and present achievements. The fast changes that are taking place in science and technology ~~as~~ also in socio-economic conditions demand corresponding fast changes in education. "The long term strategy should take into account the objective conditions in the economy and the likely developments over the planning horizon", states the Seventh Five-Year

Plan of India. The demographic perspective provides the starting point for determining a long-term development strategy. It is estimated that the proportion of persons below 15 years of age would come down from 39.7 per cent of total population in 1980 to 36 per cent in 1990 and further to 31.6 per cent in the year 2000. This will mean significant changes in planning strategies for educational development. It would be necessary to project not only student enrolment at various levels of education in different parts of the country but also estimate requirements of physical facilities and teachers, etc. Factors such as rural-urban migration, changes in occupational patterns, manpower requirements, the growth rate and improvement of the quality of life of the people may greatly influence the educational system. The future development of education may also mean a fair assessment of likely resources available from time to time, mobilisation of additional resources and utilisation of existing resources to an optimum level. All this may be possible only through modernisation of the planning process through the application of new technology. Moreover, planning is not a one time exercise. It must have an in-built mechanism to adapt itself to the changing needs.

The NPE 1986 enunciates some new concepts like delinking of degrees from jobs, national testing service, women's empowerment, innovations, research and development, etc. These concepts would require planning to be very dynamic. The kind of planning processes that we have at present would need complete overhaul.

Delivery System

With the advancement of space science and technology in India and its use in education through Indian National Satellite(INSAT) system, the whole delivery system in education is fast changing. This poses a great challenge for educational planners and administrators to adapt themselves to the changing requirements. It should be possible, with the use of this kind of technology to cut across the boundaries of space, time and resources. We have not yet been able to achieve two major national goals,viz. universal elementary education and removal of adult illiteracy. The new technology and the mass media should enable us to reach more people in a short time, increase productivity of the system and raise the quality of education. It is not just the formal system of education which will help us to achieve our objectives. The goal of lifelong education through non-formal and distance learning will have to be pursued vigorously.

Modern technology should be considered as a means to improve the efficacy of the educational system. The existing machinery for educational administration has become more or less outmoded. The inspectors of education have neither the ability nor the necessary wherewithal to manage the fast expanding school education system. At the higher education stage, things are much worse. Courses are not completed on time; examinations are not held on schedule. The machinery for supervision exists, but only in name. What is needed is a proper monitoring and evaluation system. Apart from participatory self-assessment system which should be obligatory for all educational institutions and programmes, progress of each institution and programmes has to be monitored and watched. This is possible through computerised data system and constant feedback.

Training of Planners and Administrators

Video, TV, educational broadcasting, micro computers, word processors, cassettes, films slides and overhead projectors have undoubtedly become an integral part of education. More than that they have also to form an essential part of the planning and administrative processes in education. Planners and administrators have, therefore, not only to keep themselves abreast of the large potential of these new technological aids but also make use of them to discharge their functions.

The training of educational planners and administrators has thus to adopt unconventional approaches. It has to be organised in such a way that the educational functionaries are equipped with necessary knowledge and skills in the use and application of the new technology.

One of the major difficulties that we have faced in the past for training of educational planners and administrators is to cover a huge number of functionaries through face-to-face training programmes. This has resulted in a large proportion of functionaries remaining unacquainted with the new techniques of planning and management. Distance education in educational planning and management through the use of video, audio cassettes and mass media besides print has now come in handy to reach large numbers throughout the country in a shorter span of time, and at less cost. The National Institute of Educational Planning and Administration which is an apex body in the field of educational planning and management is already involved in providing on-the-job training through open learning system in the area of educational planning and management.

Some Action Points

The following are some of the action points in so far as the use and application of new technology for planning and management of education is concerned:

a) A crash programme of training of educational functionaries at state, district, block and institutional levels has to be organised immediately in all States and Union Territories. District Institutes of Education and Training (DIETs) and State level machinery for training of educational planners and administrators, as envisaged in the National Policy on Education should be created immediately.

b) Training has to focus on use of new technology for purposes of planning and administration with particular reference to district level planning and administration. It should not only sensitise functionaries about the new technological changes but should also equip them with necessary skills to handle new technology.

c) Training of trainers will have to be arranged on a large scale. This would require strengthening of institutions like NIEPA, IIMs and State Institutes of Public Administration.

d) Training materials including software packages should be produced to cater to the new needs.

e) Distance Education techniques should be used, in addition to face-to-face training, for equipping the functionaries with new knowledge and skills.

f) Diffusion of innovations and experimentation in the use and application of new technology should be done on a planned basis.

g) All future planning, management and decision making in education should be guided by a strong Management Information System.

h) Supervision, monitoring and evaluation processes should be modernised with the help of new technological aids.

Networking

The new technology, indeed, opens new vistas for educational planners and administrators who have a major task to perform for achieving the goals of educational development to take the country forward to the twenty-first century. Effectiveness of the use and application of such technology will increase considerably if a net-working approach is adopted and a system is developed by which various institutions come together and share their expertise and resources not only in the development of software packages but also in training, research and other activities. This may reduce costs; at the same time it may have a greater impact and bring about the desired changes in the system.

The propsed net working should take place at the level of apex educational institutions as also at the level of institutions at State, district or block. School complexes/educational complexes have tremendous potential of exploiting modern technology for improving internal efficiency and raising the utilisation of available resources. Net working is no doubt a difficult task, but is likely to pay dividends if pursued sagaciously.

Works Cited

Papageorgiou John C,. "Decision Making in the Year 2000", in *Interfaces* April, 1983.

Seventh Five Year Plan 1985-90, Planning Commission, Government of India, 1985.

Challenge of Education : A Policy Perspective, Ministry of Human Resource Development, Government of India, 1985.

National Policy on Education 1986, Ministry of Human Resource Development, Department of Education, Government of India, 1986.

Programme of Action, Ministry of Human Resource Development, Government of India, 1986.

Singhal R.P., *Teacher Pupil Ratios for Schools in India,* NIEPA, New Delhi, 1986.

———, Raising Management Efficiency Through Modern Technology.

Sprague H. Jr. Barbara A., McNurlin, (Eds.), *Information Systems : Management is Practice,* Prentice Hall, New Jersey, 1976.

13

THE IMPACT OF MODERN TECHNOLOGY ON TRAINING

T. Raman

Introduction

In this chapter, I will discuss the technological leaps taken by the Indian Navy in the last two decades and will highlight lags inherent in the training institution, and in brief discuss the instructional technology, the need and use of the latest training aids for more efficient training.

There has been a phenomenal increase in technical training at all levels and in all countries. Training is now a matter of vital national importance and is properly regarded as a major concern of educationalists, industrialists, and government departments responsible for economic planning and development. Education and training are recognised as prerequisites of manpower development and economic growth and therefore, as a national investment for the future.

Training officers and instructors should keep an open mind for all new ideas and examine them critically; however, unless the results of research can ultimately be translated into simple terms capable of practical application in a real training situation for the benefit of trainees and instructors, then, time and money is likely to be wasted. Instructional technology must keep in mind its primary objective: to help instructors instruct and trainees to learn.

Introduction of Sophistication

Sophistication was introduced gradually; use of simple servos using hunter type contacts operating DC motors through relay controls was the first step. Gradually valve/magnetic amplifier operated servos came into being. Guns, gun direction system, computers, etc. were automated using electro-mechanical and electro-hydraulic servo systems. This resulted in shorter response time and a much higher degree of accuracy, the probability of hits approaching almost one. The volume of equipment increased due to the additional gadgets. The total number of personnel required to look after the system reduced, but skilled and semi-skilled personnel were required. Emphasis of professionalism in training increased, spare gear management became a dedicated area. Powerful forced ventilation of equipment compartments became very necessary due to the heat generated by the equipment. All these resulted in increased power generating capacity on ships.

Miniaturisation/Micro-miniaturisation

A large ship is an ideal target for enemy attack. Thus efforts were directed at finding ways and means of reducing the size of equipment, and the ship's complement so that more fire power could be packed. The introduction of transistor and later micro-processor based equipment, reduced the size drastically. Bulky and heavy guns were soon replaced with missile outfits. These, reduced the manpower requirement to a great extent. However, the requirement now, is more for highly skilled personnel. Since more equipment could be packed into smaller spaces and these equipments were heat sensitive, air-conditioning of ships became a necessity. These increased the electric power requirement of ships to a great extent. Also requirement of spare gears, shore support facility etc., increased manifold.

In short, the Navy today encompasses a very large spectrum of technology and it imposes tremendous loads and expectations on training. I would define training as the process of matching the men to material requirements of the fleet. The complexity of the training problem is considerable. Changes in the long term programmes of ships or in the intended equipment outfits occur frequently and these coupled with alterations to career patterns of Naval personnel, lead to the requirement of regular updating of the training programmes.

Need for Trained Manpower

Thus, there is an urgent need to step up output of professionally competent and highly motivated manpower for our training establishments and to man new acquisitions/projects. Ideally, the training establishments should have adequate staff (as per NSEC norms), who are well trained and motivated; have infrastructural facilities for individualised practical training on onboard equipment and backed up by modern technological teaching aids to supplement instructors' efforts to enhance the process of learning and to enable personnel to man the crafts with confidence. However, the ideal situation seldom exists. Two problems which forever haunt an effective training are:

(a) Multi-source acquisitions,
(b) Shortage of staff and training facilities.

These problems for the time being have no solution and we have to learn to live with them. However, what can be done, is to design a training system which is flexible enough to cater to the above-mentioned problems.

Solutions and Recommendations

One way to circumvent the above, will be, to go in for modern training techniques. Many functions involved in the instructional process, can be performed by these training aids as:

(a) They can store information until it is needed or wanted.
(b) They can distribute it over distances to reach the trainee where he happens to be, instead of bringing him to the instructor.
(c) They can present the information to the trainees through various senses and in many modes.
(d) They can give the trainee the opportunity to react with the material and respond in many ways.
(e) The programmes can be repeated any number of times.

In short, the trainees' opportunities for learning can be enhanced by using a wide range of instructional technology. All the available resources for instructions, including the instruction can work together to create conditions for maximum effective learning. The instructor can provide the missing link—the two-way communication, by clarifying trainees' doubts, by citing day-to-day examples, tutorials and group discussions, as appropriate.

Instructional Technology

Instructional technology can be defined in two ways. In its more familiar sense, it means the media born of the communications revolution which can be used for instructional purposes alongside the instructor, textbook, and blackboard. In order to reflect present-day reality, we have had to look at the pieces that make up instructional technology: television, films, overhead projectors, computers, and the other items of "hardware" and "software". In nearly every case, these media have entered education independently, and still operate more in isolation than in combination.

The second and less familiar definition of instructional technology goes beyond any particular medium or device. In this sense, instructional technology is more than the sum of its parts. It is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction. Though, only a limited number of instructors have attempted to design instruction using such a systematic, comprehensive approach, there is reason to believe that this approach holds the key to the contribution, technology can make to the advancement of education.

Costs of Instructional Technology

Any consideration of instructional technology would be incomplete without a look at costs. Occasionally, technology saves money for institutions, for instance, when closed-circuit television reproduces the lecturer in multiple classrooms. Many believe that wide-scale use of certain kinds of technology, with corresponding reduction of initial investment costs and well-planned operating procedures, could effect economics in education. But a true technology of instruction that integrates human and non-human resources into a comprehensive system to improve learning is unlikely to save money. Quality becomes high.

There are several factors which contribute to the high cost of instructional technology, on top of the large initial investment in complex equipment such as computers, television, and talking typewriters; specifically, the cost of:

(a) Developing and testing high-quality programmes.
(b) Providing time for instructors to gain understanding of technology, to learn the technical skills necessary, and to plan programmes.
(c) Employing media specialists and instructor aids.
(d) Maintaining equipment.

We have become victims of our own technological genius. But the same energy and skill which gave rise to these problems can also be marshalled for the purpose of conquering them.

Some technological teaching aids are discussed in the succeeding paragraphs.

Video Films

The introduction of video films in teaching has revolutionised training methodology. The inputs required to be given to training has vastly increased. The technological element is of a very high standard. In order to reduce the duration of courses and simultaneously maintain and improve the quantum and quality of training, it has become imperative to exploit this media to the fullest extent in modernising training methodology. This medium has obvious advantage over 16mm and 35mm films, as

(a) video film shooting is comparatively simple and can be handled by existing staff.
(b) easily portable; can be used even on small ships.
(c) cassettes can be erased and reused.
(d) can be connected to monitors for viewing in different classrooms or by small groups of trainees.

A video-film on "test equipment" produced by the faculty of Electronics Engineering, INS Valsura, is an example of how video film can be used as an instructional aid.

Computer-Aided Instruction

More recently, computers have been used as sophisticated teaching machines. In this mode, a computer interacts tutorially with a trainee, so that, he moves through the course material at a rate and in a sequence, determined by his responses to questions contained in the material. Some of the larger computer-based systems operate under a time-sharing programme which means that the same computer can give individualised instructions to many different trainees concurrently. In actual practice, the computer processes the trainees in turn rather than simultaneously but because of its great operating speed, the computer can cycle through all trainees so rapidly that no individual experiences any significant delay between input of a response and receiving feedback from the computer.

The advantages of a computer-based teaching (CBT) lesson over other distance learning methods, may be summarised as:

(a) *Dynamism*: The contrast between learning a skill from a textbook and actually practising it is immense. With CBT the dynamics of the situation can be incorporated. This reaches its highest level in a full-scale simulation. But the skills of recognition, diagnosis and decision making are far better taught by computer methods than by classroom teaching or textbooks.

(b) *Identification*: The CBT programme will usually identify with the trainee, calling him by name throughout the lesson.

(c) *Participation*: It is necessary for the trainee to participate fully in a CBT lesson, as the lesson will only progress with the continued input from the trainee. It is just not possible for him to become inattentive.

(d) *Reinforcement*: Each point made in a lesson is reinforced—mistakes are corrected, usually by referral to another part of the lesson, and correct answers rewarded.

(e) *Scoring*: Each trainee is identified and his performance monitored. The instructor can, therefore, assess the programme disc at intervals to check which trainees have taken the lesson and what their scores were.

(f) *Individual tution for more trainees*: CBT is ideally suited to training, where there are many trainees to be trained in a short period, especially when teaching resources are limited. Trainees can spend long hours in "self-study" with a micro-computer.

It is suggested that computer-based teaching aids be set up at all 'A' grade training establishments and on board training squadron ships.

Simulators

In advanced Navies, simulators are used for training. It is particularly useful in training operators. For learning to be effective, a combination of instruction and practice is essential. As the necessary practice can rarely be performed on the actual equipment, there must be a large element of simulation involved. More so, with the need to minimise fuel consumption, (till, if ever, nuclear propulsion comes into our service) the amount of time that ships are able to spend at sea doing on job training will need to be curtailed.

The advantages of simulation training are:

(a) *Controllability*: Conditions in the simulator are known and may be controlled by the instructor, so that precisely controlled training may be given.

(b) *Repeatability*: An exercise may be repeated, under identical or changed conditions, as often as required, to emphasise particular points or to provide additional training.

(c) *Failure training*: Conditions in the simulator may represent those, which would not be feasible in reality, because of safety considerations. A ship operator is not going to be willing to allow his ship to be placed at risk to enable trainees to practise close quarters manoeuvreing, and it is totally unrealistic to train engineers in failure diagnosis and operations of a real plant.

(d) *Cost and time saving*: Although a simulator represents a major item of budget, it is in nearly all cases, very much cheaper than acquiring or operating the real plant; particularly when availability is considered. The simulator does not depend on tide or weather conditions for it to be available, and an exercise may be restarted in a totally different ship condition in a matter of minutes.

We have already made a modest beginning by introducing simulators for training operators in certain highly technical fields. The process should be continued to impart training and practice to users/ operators.

Impact of Modern Teaching Aids

In advanced countries, use of the latest teaching aids has helped to reduce course durations by 28 to 30 per cent. Alternately, corresponding additional information/skills were imparted in the existing duration.

Conclusion

In spite of modern technological teaching aids, the instructor remains the single most important element in imparting training. The teaching aids only supplement the efforts of the instructor to enhance the learning process, and are not a substitute for him. It is the instructor who provides the human touch as well as the two-way communication and holds the trainees' interest, through clarifying their doubts by quoting day-to-day examples from his vast experience.

14

SOME ASPECTS OF ECONOMICS OF EDUCATIONAL TECHNOLOGY

N.V. Varghese
J. B. G. Tilak

> ...In order to avoid structural dualism, modern educational technology must reach out to the most distant areas and the most deprived sections of beneficiaries simultaneously with the areas of comparative affluence and ready availability.
>
> Educational technology will be employed in the spread of useful information, the training and retraining of teachers, to improve equality, sharpen awareness of art and culture, inculcate abiding values, etc., both in the formal and non-formal sectors...
>
> (Government of India, 1986)

Introduction

The role of technology in educational development is being increasingly recognised in the rapidly changing world of technology. India is no exception. The National Policy on Education 1986 emphasised the role of educational technology in the development of education. However, an economy's choice of a technology among the available several alternative technologies depend, *inter alia* upon economic aspects of the technologies. Priority should be accorded in the selection process of technology, *ceteris pari bus* to what costs least, and/or which is most cost effective. The present chapter discusses a few major aspects relating to economics of educational technology. This should not be viewed as an exhaustive treatment of the problem, but as an overview of economic problems relating to prospects of educational technology in developing economies like India.

The following section starts with a brief discussion on the financial crisis in education that is partly responsible for a search for alternative technologies of education. Section 3 provides a short introduction to the growth of educational technology. A discussion on the analysis of costs of educational technology is the content of Section 4. Section 5 presents a quick synthesis of the conclusions of the research in the area. The paper ends by outlining the prospects of educational technology in economically underdeveloped countries like India.

The Financial Crisis in Education

Following 'the human investment revolution in economic thought', initiated by Theodore W. Schultz in 1960, expenditure on education has increased manifold in all the countries of the World—the developed, the underdeveloped and the least developed. The public expenditure alone increased in the world by ten times during the last two decades. The new awakening on the role of education, particularly in the newly independent countries, has resulted in an unprecedented growth in the demand for education. The increase in expenditure is not adequate to meet this increasing demand for education. The general unfavourable economic environment on the one hand, and on the other and more important side, the changing priorities have led to growing financial squeeze for education. As a result, almost all countries of the world face the problems of inadequacy of resources for education. The problem is obviously more severe in the developing countries. It is believed that the level of public expenditure on education in many developing countries has reached a saturation point. It is also predicted that education systems throughout the world are not going to be better off, if not worse off, in the near future, as far as the resource position is concerned (Coombs, 1985). Thus neither could the demand for education be regulated in the modern states, nor could resources for education be increased satisfactorily.

An additional problem, in this context, relates to the shortage of trained efficient teachers. The formal system of education does not allow reducing the number of pupils per teacher significantly. The result is, while a very small number of educational institutions are endowed with good teachers, a vast number of schools have to be run with quantitatively and qualitatively inadequate teachers.

In this overall context of resource constraints, when a concerted search for solutions to the problems began, modern technology appeared with the potential of providing a solution.

Further, the conventional system of education is characterised by rising unit costs, low quality of education, relatively poor access to rural children, slow response to development needs and rather regressive effects (Jamison and McAnany, 1978:23). Proper and large-scale use of modern educational technology is believed to be able to help in overcoming these problems.

How effective will be the role of technology as a solution to these problems can be expected to depend upon the basic economics of educational technology, which we briefly outline in the following pages. Before we proceed further, a short introduction to changing technology in education may be called for.

Growth of Educational Technology

Until the invention of writing the only way of learning was by human contact and the system continues today as the most effective system of learning. *Gurukulas* of the ancient India and the schools of the modern days, all belong to the same kind, based on the principle of human contact. However, the invention of writing is a major breakthrough in educational technology which enabled the communication of knowledge to extend beyond the presence of a given individual. With the invention of printing machines, a significant leap in educational technology i.e., the school system, directly on the one hand, and on the other, it resulted in alternative forms of learning, viz., distance learning system or open learning system. In the earlier phases of distance teaching, the postal system was relied upon. From the 1920s the radio was increasingly used. In the 1970s and 1980s audio and video systems have taken over all other systems. In other words, development in communication technology and in audio, video and computer-based learning and new designs in print-based materials, resulted in a revolution in educational technology.

Thus today there is no one unique technology for educational development. Print material, radio, television, computers, telephones, films etc., are some of the available forms of educational technology. Media like slides, overhead projectors, tape recorders, photographs, etc., are mere teaching aids like the blackboards, maps, textbooks, etc. They are a part of the educational process and it is difficult to think of them as alternative technology. Various modern technologies of education can be classified into three categories, depending upon their capability, as follows: (a) Audio and audiographic technologies that include radio, telephone, dial access, electronic blackboard, Slow Scan

Television (SSTV), facsimile, etc. (b) video technologies like Instructional Television Fixed Services (ITFS), cable, satellites, broadcast television, and (c) computers, including central computers, remote terminals, time-shared computing, etc., (see Grayson, 1982). However, all these are not alternatives to each other, in the sense that most often a combination of two or more is opted for. Further, they are also adopted, not necessarily in all cases, as alternatives to conventional forms of schooling. Many a time, they are used as supplements in traditional schools. Thus, there is no unique technology for educational development; technology also changes with changes in the levels of education.

From 1960s onwards, the Third World countries are increasingly attracted by the multi-media-based distance teaching as a solution to resource constraints in expansion of educational systems. Since, self-learning is the crucial factor in the media-based education, its successes vary between different levels of education. Hence certain technologies become level specific.

At lower levels of education teachers' help is more important for learning; the effectiveness of media is rather limited. For example, children at the primary school level belong to young age groups who need close attention and assistance to learn. Therefore, at this level formal institutions like schools and formal teaching assistance from the teachers therein are essential. Therefore, the media cannot substitute teachers at primary level. As an example, one may note that Radio-primaries in Mexico aimed at providing an additional teacher in primary schools with the help of radio programmes. But it did not improve pedagogical quality. Evaluation of effectiveness of media-based education in general, shows that "there was little success in using distance teaching to offer primary education" (Perraton: 1982:10).

At the secondary levels, the situation is different. The students belong to higher age-groups and they have some amount of learning experience. Therefore, reliance on teachers can be reduced. Media-based distance teaching at secondary level is used to meet the demand for secondary education in three ways: (a) for equivalency programmes (see Perraton 1982, for a few examples); (b) for altogether different kind of education (e.g. the Tele-Niger Project); and (c) for quality improvements. In many an instance, media are used as a teaching aid to improve the quality of education. However, teacher substitution possibilities do exist at this level. But exclusive reliance on media will not be desirable. Therefore, media becomes an important device to improve the quality of existing educational system. For example, instructional television in the Ivory Coast, instructional television in Maranha and Ceara, Brazil, and Radio Mathematics Project in Nicaragua primarily aimed at improvement of quality, even though the Ivory Coast has not shown any marked qualitative improvement.

At tertiary levels of education media are used primarily to spread education. In other words, qualitative expansion is the primary focus at this level. The students at this level are of employable age-group and capable of self-learning. Moreover, enrolments in open universities show that most of the clientele are either employees, or women or those who could not get into formal institutions. Therefore, accessibility becomes the primary focus of modern technology based education at higher levels, whether it is Everyman University in Israel, or the Television University Project in China.

To sum up, success of media-based education is related to levels of education and the purpose for which it was introduced. At primary levels modern technology may be ineffective both from economic and pedagogic points of view, since teachers cannot be substituted. At secondary level, technology becomes an effective supplementary device to teaching to improve the quality. At higher levels of education maximum possibilities of substitution of teachers exist and therefore media, to a great extent can be relied upon for increasing accessibility.

This distinction is important from the cost analysis point of view. If technology is used for quality improvement programmes, it is very difficult to identify its impact on quality. Even if identified, it is difficult to measure. But when technology is used with the primary objective of increasing accessibility, the inputs as well as outputs are more easily identifiable and measurable. Costs of such a system can be easily compared to the conventional institution based teaching systems. In other words, cost-effective analysis would be more easily possible.

Pefore we discuss the cost factors, a couple of points relating to factors other than costs may be noted. First, regarding the accessibility of the technology: whether a technology is available within the economy or not. If yes, at what cost? If not, can it be imported? Whether transfer of technology is desirable? And is the foreign technology relevant for domestic needs? These are some of the major questions that need detailed analysis. But we are not directly concerned with these questions in this paper.

The second question refers to the feasibility of application of a technology or applicability of a technology. Whether hardware, software and manpower with required skills to apply a technology are available within the economy or not. If available, at what cost? If not, how to procure the hardware and software and how to produce the required manpower? While these are questions relating to a wider framework, with socio-political implications, they may finally turn out to be economic ones. Economics is only one of several sources of pressure which influence the choice of technology. Other important areas lie in the spheres of politics and sociology. At the same time, "one of the most striking difference in the new educational technology lies in its economic character" (Randall and Blaschke, 1973:83).

Let us discuss some important aspects relating to economics of educational technology in the following section.

Analysis of Costs of Educational Technology

Economics of media system should take into account two important features (Wagner: 1983) of media use that were noticed in the recent decade: (1) the growing international use of media; and (ii) increasing cost of instructional media system.

At present a large number of countries and international agencies are increasingly resorting to media-based education. Therefore, choice of educational technology becomes important. The final choice of educational technology is based on the relative cost-effectiveness of the media.

Technological development had a dual impact on the educational media. In the first instance, over the years the cost of any particular piece of media equipment has come down. Therefore, media equipment has become cheaper for the individual consumer. On the other hand, the media system, which incorporates this equipment has grown larger and more complex. And hence the total cost of the media system has gone up. Therefore, media becomes too expensive for the institution which uses it. This is generally applicable to all media systems.

The cost of media and composition of costs vary between different media. In some cases the fixed cost may be relatively higher and the variable cost lower and vice versa. Wagner (1983) has divided the cost composition of film media into three : (i) costs for providing initial or master copy; (ii) costs of providing duplicate or subsequent copies; (iii) costs of distributing or presenting to the students. In other words, costs consist, in general, of initial production cost, reproduction costs and distribution costs. At each stage, there will be fixed and variable costs. Therefore, the cost analysis involves in estimating the fixed costs and variable costs of the media. In the following paragraph we will attempt to discuss some important aspects of cost estimation of media system in general.

In the media-based educational system the fixed element of cost will be likely to be higher both in absolute terms and as proportion of total costs. In other words, the ratio of fixed to total costs will be high. This is more true in the initial phases. But once the project is on, expansion may become cheaper. In other words, in the media system installation cost is always higher and expansion cost becomes cost advantageous, i.e., media is expensive to start with, but becomes cheaper as one continues to use it.

Generally fixed costs and capital costs are used interchangeably. However, in media systems there needs to be a distinction between these two. While capital costs will be fixed in nature, fixed costs involves other items also. Fixed cost is fixed only in the short-run. However, in media system, a cost is 'fixed' in relation to the units of output one is using. But fixed cost varies with the nature of units of course material produced. For example, suppose there are 5,000 students in a media-based education system. If all of them opt for the single course, this will not increase the teacher cost, hours of working of the teachers, etc. On the other hand, the reproduction and distribution costs will be relatively high. Now let us assume that the total number of students remain the same, but the number of courses offered is increased. This will involve recruitment of more teachers; so the teacher cost will be going up. Therefore, it is not the absolute number of students that is important, but number of courses offered.

In the conventional system, teacher cost is a variable cost depending upon the number of students. In the media system teachers' cost is a fixed cost and is independent of the number of students. The larger the number of students, per student teacher cost will come down but not the total teacher cost. On the other hand, in the conventional system, teachers increase in relation to the number of students based on the notion of fixed teacher pupil ratio. So per student teacher cost will be the same regardless of the changes in the total teacher cost. But total teacher cost will be varying.

To make cost comparisons, one has to estimate total and average annual costs. Both fixed and variable costs have to be included in the etimation. Once annual total costs are estimated, average cost calculations follow. The important question to derive average cost from total cost is the selection of the unit based on which average cost is to be calculated. Variable costs being incurred annually, an addition of all costs incurred on this account will give us the total variable cost. Therefore for cost comparison purposes, what is difficult to estimate is annual capital costs.

Since capital costs are incurred once and for all, we have to calculate the capital cost annually which requires an allowance to be made for the costs of capital and wastage of capital (Wagner 1983). In general, costs of capital is measured in terms of interest paid and wastage of capital by its depreciation over its lifetime. Interest paid does not mean the total interest paid. For the estimation, only a part of the total interest that is related to the actual amount of capital tied up for each year, will be taken into account.

It can be seen that annual calculation of capital cost is very sensitive to changes in the rate of interest and the assumed lifetime of the equipment. Since, capital costs being huge in the media system, a small change in the interest rate will make a substantial change in the annual capital costs.

Now let us consider some of the fixed costs. We have seen that unlike the conventional system the teacher cost is a fixed cost in the media system. It is independent of the number of students, but is dependent on the number of courses offered.

Similarly, laboratory cost is also a fixed cost in the modern technology-based educational system. In the conventional system, laboratory cost varies depending upon the number of students. In the media-based system laboratories are essentially for teachers and hence varies according to the number of teachers. Since the number of teachers required is independent of the number of students, the number of laboratories required is also independent of the number of students.

The cost of building, furniture etc., is also fixed irrespective of the number of students. Therefore, expansion of the system in terms of student numbers will not increase fixed costs on these accounts. One of the major items in the variable cost in a media-based system is the contact classes or summer schools. This varies according to the number of students, number of days of contact classes, and accommodation for the students. However, calculation of cost in this case will be similar to that of the conventional system.

Variable costs also depend on the technology chosen. In print medium variable cost is in terms of papers, postage, etc. In a cassette-based system variable cost takes the form of reproduction cost, cassette cost and distribution costs. These costs are easily identifiable and measurable.

Therefore, for estimation of average cost we should have three components: (i) annual capital costs; (ii) other fixed costs, and (iii) variable costs. Adding up these three and dividing by the relevant units (for example, pupils if one is interested in average per pupil cost) one arrives at the average cost which can be used for comparative purposes. While making comparisons, one has to take into account the pattern of utilisation of the media in question. Average cost should be estimated after standardising for utilisation.

Economics of technology lies in realisation of economies of scale and the extent of substitution possibilities. Economies of scale can be realised if it is a mass-production-based system. For realising the advantages of a media-technology-based system, there should be a large number of consumers, i.e. students demanding a given type and level of education should be large in number. Economies of scale will not be realised in the early phases of the project. The initial cost being high, and cost of expansion less, attempts to make cost analysis in an early stage may perhaps yield misleading conclusions.

The second important aspect of economics of media lies in the realisation of substitution possibilities. Teacher cost being the highest proportion of the educational expenditure in the conventional system, substitution possibilities primarily boil down to teachers, and media system gives a good scope for substitution of teachers, especially at higher levels of education.

The Experience

Modern technology has been extensively used for educational development in many countries of the world. There is also a significant amount of research conducted on the effectiveness of the technology in a good number of countries. Eicher et al. (1982) noted that there were more than 30 studies on the problem. Obviously today the number is much larger. Some of the research is documented in Perraton (1982), UNESCO (1980), Jamison et al. (1978), etc. A quick synthesis of policy relevant implications of this research would be useful for any economy that is planning adoption of technology, even though the conclusions of an experiment or a project in an economy cannot be universalised and the methodologies may not be strictly comparable.

On the whole, it has been found that modern technology-based distance teaching is not necessarily a cheap way of solving educational problems.

While in most cases, cost per student in modern technology-based distance teaching is less than the cost in conventional forms of schooling, the effective cost, i.e., cost per graduate is not necessarily less in the case of modern technology-based distance education. In Malawi, for example, the cost per student in correspondence college is 62 per cent of the day secondary schools and 23 per cent of boarding schools but the cost per graduate is 60 per cent higher than day secondary schools, and 27 per cent less than boarding schools. In South Korea the cost per graduate in Air Correspondence high schools is 29 per cent of the regular high schools; and in Israel cost per graduate in Everyman University is about 50 per cent of the traditional universities. But in Kenya the cost per student as well as per graduate in inservice training is believed to be quite high (Jamison and Orivel, 1982). The cost of Nicaragua Radio Mathematics programme was also found to be quite high. But in Kenya the number of students using the correspondence unit is too small for it to reap economies of scale from the use of technology (Perraton, 1982:22). The same is the case in Brazil (Telecursco Secundo Grau). Costs of secondary education in the IRDEB project in Bahia (Brazil) based on the radio were higher than those of the traditional system. The pass rate is also lower. Where there are cheap orthodox methods of education, it may be difficult to attract students. The threshold size of enrolment for radio-based programmes is around 2,000 (Eicher et al. 1982:58).

Let us attempt at generalising a few major conclusions on the costs of educational technology. First, two general broad conclusions can be summarised as follows: Cost per student and per year is generally lower in modern technology-based education system than in traditional system, but the total costs of the system may be rising; and the costs may even sometimes be lower in a multi-media system than in traditional systems, or a system based on single technology.

In addition, we note the following:

The relative costs of these alternative technologies and their various components are important. The available evidence (see UNESCO:1980) indicates that :

a. investment and fixed costs are higher and operational costs are generally lower in the case of modern technology-based education than in the case of traditional system.
b. the costs of production of audio-visual educational programmes are, in general, much higher than the costs of distribution and costs of reception, i.e., transmission and utilisation costs, when it is possible to use an existing broadcasting network. Otherwise even costs of reception would be very high.
c. the economies of scale are very high in systems using mainly radio, television or computers; the marginal costs are thus very low when there are a large number of students.
d. for all sizes of operation, the costs for systems using television are 3-10 times higher than for systems using radio; and the costs of computer-assisted learning system are 10-15 times higher than those of systems using television. Fixed costs are ten times higher for television than for radio.

There are two related issues when we refer to the effectiveness of alternative technologies; one, the impact of the technology on pedagogical quality and the other on accessibility. The available evidence on the impact on technology-based teaching on pedagogical quality is not very conclusive. While the quality of technology-based teaching is found to be an improvement over conventional methods in the case of Brazil (Maranho, EMTVE and Telecurso Secundro Grau) and Kenya (inservice teacher training), the improvement is small in Mauritius (College of the Air) and Mexico (Telesecundrial). But the quality of the traditional learning methods is superior to modern media-based distance teaching in Malawi (Correspondence College), Brazil

(Bahia Madureza Project), and South Korea (Air Correspondence High School), while there is not much difference between the two in Mexico (Radio-primario) and Brazil (Ceara Educational Television Project). After all, it should be noted that "technological devices can only help to improve the efficiency of an educational delivery system. They cannot by themselves improve the quality of education" (APEID, 1982:35).

But with respect to accessibility, evidence is stronger in favour of application of modern technology in education. Modern technology-based education systems are found to be more progressive than traditional systems. It provides greater access to economically poorer groups, socially disadvantaged groups and in rural areas, besides improving geographical access, in general. It is only in the case of Brazil (Bahia Madureza Project, and Ceara Educational Television Project) and in Mauritius (College of the Air), that no significant effect of technology on access could be found. Another case is China's Television University which improved access significantly in urban areas. However, it is increasingly felt that with proper design, the redistributive potential of educational technology could be enhanced substantially.

There is, however, one weakness in the structure. Mostly the clientele group of technology-based educational system like distance learning or open learning systems, besides having less human contact with the teachers consist of disadvantages segments—those who secure less scores in examinations, those who are employed or housewives and cannot devote full time for education, and those who do not have other educational support like libraries. Since the inputs are of relatively low quality, most of the output may be of lower quality—the graduates ending up with third divisions and adding to the educated unemployment. On the other side, it is also argued that the clientele group is more mature and may perform better than the pupils in the conventional system. The available evidence is not very conclusive on the subject.

The Prospects

On the whole, what are the prospects of new technologies in education?

Based on the survey of several studies, Eicher et al. (1982) comment on the prospects. Television remains "an expensive medium for poorer countries... educational television cannot be cheap, and should not be recommended as long as a significant proportion of households are not equipped to bear a significant part of infrastructure fixed costs." On the prospects of radio versus television, Jamison and McAnany (1978:9) observed that "although continued technological innovation will make television broadcasting increasingly available to audiences in low income countries, the constraints of costs and technical training for the television medium will leave radio dominant in these countries for at least another decade, and probably through the end of the century."

The evidence on the cost of computers in education is not clear. In the PLATO project at the University of Illinois (USA) hardware costs were found to be dominating, while in ETS/LAUSD project at Los Angeles (USA) software costs dominated. While "hardware costs will have no more than marginal importance, ... there is no reason to anticipate a decrease in software costs" (Eicher et al. 1982).

With regard to the role of films in educational development, it is noted that the cost of films is quite high and film is no longer in a phase of decreasing costs. In fact, it is found that "costs of films are higher, and continue to rise and might soon become prohibitive" (Singh, 1982,219). From an economic point of view "a significant use of film for educational purposes is probably doomed" (Eicher et at. 1982:60)

Then the two-way radios or telephone-based systems are almost at prohibitive prices. After all the teacher should be waiting all the time. Hence, it is necessarily costly and not economically justifiable in general.

Modern technology-based distance education is in its infancy in India. Therefore, a proper empirical analysis of the cost advantages of educational technology is not possible in the given Indian context. Based on the available evidence Singh (1982) concludes that "video presently seems to tower above all media" in India. In the coming years with the efforts regarding the open learning systems, satellite television may prove to be effective in the case of India.

Irrespective of the type of technology chosen, its cost advantage to a great extent depends upon the realisation of economies of scale associated with it. The first and foremost condition for this is generating large scale demand for media-based education. This demand will partially depend upon the quality of education provided therein, and employers' evaluation of the same in the labour market. If the demand is not large enough, media-based education may prove to be uneconomical even when the hardware cost of educational technology comes down.

Works Cited

APEID, *Report of Study Group Meeting on Applicability of Advanced Technologies to Educational Development,* Bangkok, UNESCO ROEAP, 1982.

Coombs P.H., *The World Crisis in Education,* New York, Oxford, 1985.

Eicher J.C., D.Hawkridge, E.McAnany, F.Mariet and F.Orivel,*The Economics of New Educational Media* : Vol. 3, *Costs and Effectiveness : Overview and Synthesis,* Paris : UNESCO Press, 1982.

Government of India (1986), *The National Policy on Education 1986*, New Delhi, Ministry of Human Resource Development, 1986.

Grayson, L.P. "New Technologies in Education" in *Encyclopedia of Educational Research,* New York, The Free Press, 1982.

Jamison, D.T. and McAnany, *Radio for Education and Development,* Beverly Hills, Sage Publications, 1978.

Jamison D.T. and F.Orivel, "The Cost Effectiveness of Distance Teaching for School Equivalency", in Perraton (ed).

Jamison D.T., Klees, S.J., Wells, S.J., *The Costs of Educational Media: Guidelines for Planning and Evaluation*, Beverly Hills, Sage Publications, 1979.

Klees, S.J. and Wells, S.J., *Economic Analysis and Evaluation: Critical Issues in Application to Instructional Technology Evaluation,* UNESCO, 1980.

Orivel, F., *Cost Analysis in Educational Technology : Practical Problems*, UNESCO, 1980.

Perraton, H (ed), *Alternative Routes to Formal Education: Distance Teaching for School Equivalency,* Baltimore, John Hopkins for the World Bank, 1982.

Randall R., and Blaschke, C, "Educational Technology Economics, Management and Public Policy", in *Introduction to Educational Technology*, Englewood Cliffs, New Jersey, Education Technology Publications, 1973.

Singh, V., *A Cmparative Cost-Effectiveness Study of Low Cost Audio-Visual Teaching Aids and High Cost Audio-Visual Teaching Aids*, Unpublished Ph.D. Dissertation, New Delhi, Jawarharlal Nehru University, 1982.

UNESCO, *The Economics of New Educational Media: Vol. 2, Cost Effectiveness*, Paris, UNESCO Press, 1980.

Wagner, A.L., *Economics of Educational Media*, London, Macmillan, 1983.

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PLANNING AND MANAGEMENT OF EDUCATIONAL TECHNOLOGY

M. Mukhopadhyay

Backdrop

Educational technology as a field of study has been pursued in India since 1966. During this period, there has been considerable amount of research and development in various aspects of educational technology. Research in educational technology has been reviewed from time to time by Shah and Kulkarni (1974), Shah, Mehta and Kulkarni (1979), Mishra (1986), and Shukla, (in press). Various reviews reveal more than 200 research documents in educational technology. On the other hand, there has been some software development in the form of programmed learning material, self-learning modules, handbook on teaching skills, media software in the form of audio and video programmes, slide tape sequences, charts, models, transparencies, films, multi-media learning packages, computer-aided learning software, etc. Although the print, three-dimensional models as well as media software are scattered over various subjects and levels of education, together they are not negligible. Further, educational technology has been introduced as a course in B.Ed., M.Ed. and M. Phil. programmes in various universities.

Alongwith the developments in research and production of software, we have a unique position so far as development of infrastructure is concerned. We have a CIET-SIET network to take care of school level education, EMRC-AVRC network for higher education, TTTIs network for polytechnic education, IIT network for higher engineering education, IAMR for medical education and NAARM for agriculture education. This is possibly one of the most comprehensive network of infrastructures for supporting educational technology movement anywhere in the world. Further, the time on media, namely, radio and television for educational broadcast has been steadily increasing indicating another major national level support to this movement. Educational programmes are now broadcast for schools, colleges and for Open Learning Systems.

The interest in educational technology crystallised to the extent of formation of a professional society as early 1965 which is now known as All India Association for Educational Technology. This is one of the largest multi-sectoral educational forums in the country and had the involvement of some of the most outstanding scholars including late Professor V.S. Jha, Prof. S.K. Mitra, Prof. Malcolm Adiseshiah, Prof. I.J. Patel, Prof. Madhuriben Shah, Prof. M.B. Buch and many others. This Association has developed a vigorous programme of dissemination through conferences, seminars, activities spread all over the country, monthly newsletters, quarterly journals, books and video-audio software.

Management—New Challenge

The movement on educational technology received strong official support in the form of a separate Working Committee in the Seventh Plan and subsequently with a place in the National Policy on Education, and Programme of Action leading to a full-fledged scheme on educational technology in 1988. The backdrop is presumably quite impressive from any professional consideration.

However, it is also unnerving when one reviews the position of educational technology vis-a-vis grassroots, namely, the classrooms and other instructional situations in schools, colleges, polytechnics and engineering colleges. Incidentally, the situation is uniform irrespective of levels and sectors of education, be it elementary, secondary, collegiate or professional education. The research, development and limited dissemination of educational technology has thus, in a way, limited the impact of educational technology on the educational scenario. Educational technology has, by and large, remained within the boundaries of pedagogy and hardly ever been considered as a major managerial issue. In order to derive the best benefit of the potential and investments made on educational technology, scientific planning and management emerges as a necessary condition.

The planning and management of educational technology was first considered at the IAET Conference in Bombay (1984) through a key note paper (Mukhopadhyay, 1985). Subsequently, a number of deliberations were organised at AIAET and NIEPA and documents have been brought out (Mukhopadhyay 1988, Mukhopadhyay and Sujatha 1988). There have, however, been quite a few studies with significant bearing on this issue, in India and abroad (Mukhopadhyay 1988).

The planning and management of educational technology can be primarily considered as the development of a mechanism for exploiting the highest potentialities of educational technology derived through years of research and development activities in the country and abroad. From this perspective, it would be important to consider the potentialities, and critically analyse the management dimensions under few separate heads.

Policy

Educational technology equal to media is of the 1940s. It changed to individualisation of instruction in the form of programmed learning, PSI, learning modules, multi-media learning packages, etc. At a later stage, the emphasis was on group interaction and on methods like role play, simulation, in basket exercise, brain storming, etc. In Indian policy and planning documents including the Seventh Plan Working Committee Report, National Policy on Education, Programme of Action, and Educational Technology Scheme, educational technology is invariably equated with media which was the concept in the 1940s. This may be on account of two reasons. Firstly, media revolution, particularly in education in India, is a recent phenomenon. So, the time lag of media as educational technology between India and the advanced world is about 50 years. The second important reason is the unfamiliarity of educational planners and policy makers regarding the professional position of educational technology, possibly corroborated with scant regard for professional consideration of the educational process. Thirdly, educational technology with professional emphasis on disembodied components is beyond the usually available planning methodologies dependent upon numbers. Any planning and management exercise on educational technology has, however, to take into cognisance the conceptualisation, however partial and incomplete that may be.

Before one gets to the issue of media, it would be relevant to deal with the different aspects of educational technology.

Individualisation of Instructions

Individualisation of instruction in Indian education except in doctoral studies is almost unknown. There have, however, been some significant experiments on the use of approaches of individualised instruction for upgrading instructional processes in the formal classrooms. A large majority of such experiments are on programmed learning. Others are on self-learning modules, MMLPs. There is documentary evidence of more than 60 such experiments at different levels of education and in different subjects all over the country (Buch 1974, 1978, 1983, in press). The second group of experiments is on a personalised system of instruction (Keller Plan).

Without any contradiction, all such studies indicate programmed learning material and PSI to be superior learning alternatives to the combination of teachers and textbooks together. This implies that programmed or semi-programmed textbooks with teacher intervention will have significant potential for changing the outcome of learning and the learning environment in schools and colleges. The responsiveness of management in education would indicate incorporation of programmed learning material or its principles in preparation of textbooks. The NCERT which has the major responsibility of generating prototype textbooks at the school level incorporated principles of programming in the development of textbooks. The strength of new books is that these are not programmed material in the conventional sense of the term. With the promotion of the NCERT textbooks as prototypes, there have been some changes in the school textbooks in the country. There is, however, much to be desired. There could be full-fledged programmed text—for both average as well as slow learners as—supplementaries to the present form of textbooks. There are a number of books on various subjects and for various levels developed in India (Shah & Kulkarni, 1974, Shah, Mehta & Kulkarni, Mishra.) The new emphasis in the policy document on development of creativity and problem-solving ability among students would warrant initiation of new approaches to instructional systems. One of the major approaches will be on individualisation of instruction. There has not been much effort to conceptualise a mechanism of individualising instruction or even diversifying instruction according to the learner's needs. In view of new developments like setting up of Navodaya Vidyalayas, Autonomous Colleges, etc. a mechanism has to be designed, pilot-tested and launched in the near future. This is to be considered as one of the major tasks ahead in the management of educational technology.

Programmed Teaching

Parallel to programmed learning material, a part of instructional strategy is to structure the classroom teaching by the teachers. This implies structuring the presentation, illustrations, review of student learning, etc. Use of aids, worksheets, etc., are possible tools for structuring the lectures in classrooms. Research evidence provides a clue that structured teaching is a function of a set of competencies (Mukhopadhyay et al. 1981) which can be developed through a series of strategies primarily based on assessment of competencies, feedback, planning and reassessment.

We have two different experiments that can be referred to on competency-based approach to teacher development or teacher behaviour .modification. A formal Competency-Based Teacher Education programme was launched by Technical Teacher Training Institute, Bhopal, for polytechnic teachers of the Western Region of India (Saran and Chandran 1980). Micro-teaching was another approach which was initially experimented with through a large number of studies initiated by M.S. University, Baroda and subsequently sponsored by the NCERT (Passi & Shah 1973, Das, Passi 1977). Prior to both these types of experiments, many researchers tried their hands on use of Flander's Interaction Analysis Category System for teacher behaviour modification (Buch). Out of the various types of experiments which have been successfully carried out in India, micro-teaching has found a much larger place in the total scenario of teacher education. The NCTE document on teacher education curriculum also incorporates this approach under a different title, Core Skills.

At one stage, Jack Duthie, from the University of Sterling, U.K., played a major role in 'selling' micro teaching in various Indian universities. Subsequently, many other British experts, particularly Prof. Elizabeth Perrot of Lancaster University, U.K., played some role. Results of these efforts have been the spread of micro teaching as a component of teaching practice to develop skills of structuring and programming teaching in many universities and their affiliated colleges of education. The efficiency with which this programme is carried out varies widely due to the wide capability range of the teacher educators. There is a need for standardisation of mechanisms of conducting skill development employed in developing expert teacher educators across the teacher education institutions. Even if one proposed two teacher educators to be trained as experts in training in core skills in each institution, it amounts to training at least 1,200 teacher educators in the country. Thus, the development of teacher educators and then developing a mechanism for maintaining standards on teacher programming is a major issue. Unfortunately, this has not received the attention it deserves. Many experiments have proved that structured teacher behaviour in classrooms is as economic and effective as some of the well established methodologies of individualisation of instruction.

Low Cost Aids

The low cost aids usually imply charts, maps, models, etc. Use of these have been professed in teacher education programmes over the years; but actual implementation and use in classrooms is rare. Problems are non-availability of the relevant software, inadequate skill of teachers to use them, lack of incentives to innovative and better instruction. These low-cost non-projected aids hold special importance in primary and secondary education in the rural areas which await electric supply.

There are certain major issues at the administrative and organisational end too. One major issue is the mass duplication of charts. Not many good charts are available. One could easily compare quality of posters commercially produced and marketed vis-a-vis the quality of charts produced by educational publishers, and very rarely by textbook boards and other such governmental agencies. The preparation, production and distribution of charts, maps and models would have to be a part of package of professional support to schools. Some of these dimensions, fortunately, have found a place in Operation Blackboard. The scheme has to be safeguarded with close and continuous monitoring in terms of quality of charts, maps, timely supply and regular use in the classrooms. It may, however, be mentioned that when it comes to covering all children with aids, charts, models etc., these do not remain low cost. They become several times costlier than the so-called expensive aids like television, radio and even video. Singh's (1982) study is an important one in this area.

Projected Aids and Media

Projected aids are primarily modular in nature. These can be slides, overhead transparencies, films, audio cassettes, video cassettes and CAI software. To a large extent, these are almost totally absent in school and collegiate education. Firstly, neither hardware nor software is available to the institutions. Secondly, teachers are not trained and equipped to meaningfully utilise such equipments and softwares for improving the instructional process. Thirdly, wherever the hardware is available, it remains grossly under-utilised because of lack of software.

As mentioned earlier, a large number of networks have been established in India for providing media support to various levels of education. Scanning of recent listing of educational softwares from several sources reveals the existence of some amount of software (not negligible in fact) though not adequate. But the major problem is lack of any kind of information and database on educational software; and more seriously almost total absence of mechanism for dissemination or marketing of these educational softwares. Seven software organisations at school level are directly under the control of the government. There is no mechanism of marketing or dissemination for more than two decades. Similarly, UGC documents reveal nearly 1,800 video softwares in higher education produced by EMRCs and AVRCs. Colleges and Universities, however, suffer from the drought of video softwares. The problem remains the same—no mechanism for dissemination or marketing. Only recently the Electronics Trade and Technology Development Corporation (Government of India Undertaking) has began to market and disseminate educational softwares produced by various software agencies like CIET, IGNOU etc.

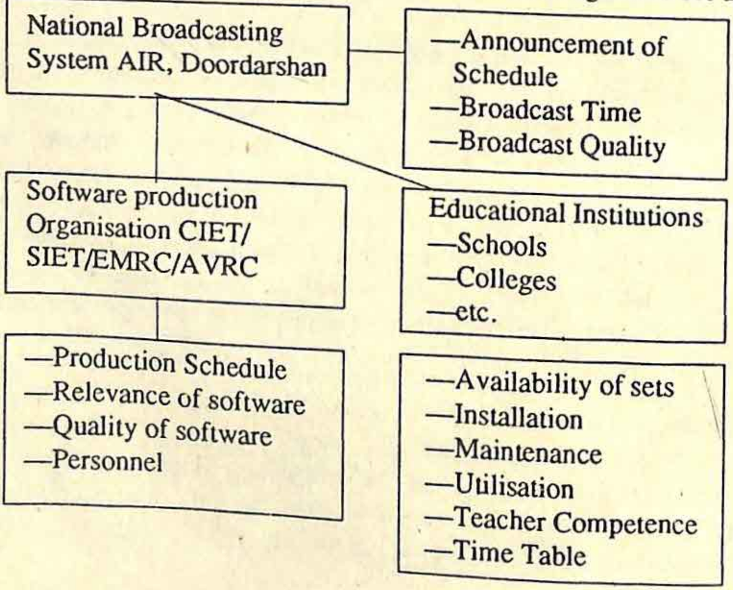
As of today, the government maintains almost a total monopoly on educational software production through exclusive funding to its own establishments. In such a secured situation, indifference to quality is possible. Encouragement and support to professional societies like Science Teachers' Association, Mathematics Teachers' Association, Association of Teacher Educators, All India Association for Educational Technology and such others, including private producers, would create a countervailing force in software production. This would force the secured officially sponsored organisations to improve quality.

The software organisations often refer to shortage of resources. While there is some truth in it, it is also not devoid of the tendency of empire building. Each organisation should have basic infrastructure sufficient enough to carry out the scheduled production, but light enough not to crumble by its own weight. After all, Ramesh Sharma, M.S. Sathyu or Sai Paranjape do not have their own studios. In fact a huge infrastructure may increase unit cost per film without actually investing on scripting, shooting, editing, special effects, presentation, sound-mixing, etc. In fact, cost studies need to be taken up to determine the optimum investment needed in infrastructure development to maintain a steady outflow of programmes.

The National Policy on Education and the subsequent documents and schemes have placed tremendous emphasis on software support for improvement of educational standards. The quality of software is an important issue and there is a wide-ranging criticism. While there is enormous scope for improvement, blanket criticism is not only unkind, but also indicates lack of understanding. Besides imagination and equipments, improvement in quality is directly proportionate to "experience" in the country. Further, the magnitude of production schedule that is necessary to maintain to feed the ETV time slots is another issue. CIET and EMRCs are under continuous pressure for faster production. This is apart from the low budget on the films.

The management of media poses a serious problem. Educational broadcasting involves three sets of agencies. The agencies, their relational sets, and management issues are given in the diagram below.

From the diagram it would be evident that production of educational (broadcast) software is in the hands of agencies set up by



the Education Department of the Government almost exclusively at central initiative. There are nearly 20 such centres across the levels with a heavy schedule of production for broadcast. Maintaining the schedule itself is a problem; particularly due to lack of adequate number of producers and film-makers available to education. The shortage of personnel and shoe-string budgets for actual production of software affects the quality of software adversely. The establishment cost of these institutes are pretty high. Hence the operative cost of softwares becomes low. In order to feed the broadcast channel, a good number of films in higher education are hired from the Indian market and abroad. The criticism of relevance of programmes emanate out of these films although many of them are of good quality.

The problem is also due to centralisation of production. Commissioning and encouragement to private production at reasonable rates can create a countervailing force to improve the quality of production. Also, their decentralisation would bring in new talents and new ways of looking at educational software.

The institutions face another set of problems, namely, availability of sets, maintenance, power supply, location, utilisation, provision in the time-table, teacher competence, etc. The NPE 1986 and subsequent steps in implementation have created the provision of sets—100,000 TV and 500,000 radio-cum-cassette players at elementary level. Although there is no statement regarding secondary education, it cannot be ignored and left behind.

The problems are of different order now. The sets available to schools may or may not be in the schools depending upon the headmaster, the local political leaders—sarpanch/mukhia or leaders in the panchayats. Even when it is in the school, the crowding of local youth and others to witness entertainment programmes are not unknown. Thus, unless an opinion is created in favour of proper use of the sets, including their utility for community viewing, the provision created now would be infructuous.

The qualitative aspects of utilisation poses another problem. Instead of harping upon teachers' apathy and negative attitude vis-a-vis educational broadcast, one must come to terms that no provision has so far been created to train teachers in the use of media to facilitate his/her task. Without this critical input, teachers perceive media as an alternative to him/her, and naturally treats it as a threat, and hence rejects it. On the other hand, there are studies that clearly reveal that the learning gain through media is a function of teacher intervention in the media programme. It would be imperative to introduce a massive programme of orienting teachers in the use of media. The initial orientation can be done through ETV and Radio broadcast. This can be followed up with short camps for skill development. The NCTE recommended introduction of training in core skills. Use of media should be introduced as one of the core skills. The teacher training institutions that use micro teaching can introduce the use of media as one of the areas.

The broadcasts also play an important role. In fact, television and radio link the software organisations and the user systems—the schools and colleges. The major issues are broadcast schedule, broadcast time and broadcast quality. The advance announcement of schedule facilitates planning of teacher intervention. Annotation on the programme, a few review questions can be developed by the resource organisation with each programme. These can be circulated well in advance in print form. Or/and, such contents and the questions can be broadcast on the previous day. Some experiments have been done with use of programme handbooks. Such practices need to be professionalised. There has been a lot of discussion and criticism of AIR and Doordarshan regarding "prime time" vis-a-vis education. By their very objective, AIR and Doordarshan would have to cater to needs of a variety of clients including recreational needs. Till a dedicated channel is available, it would be necessary for schools and colleges to adjust to the broadcast timings. No time slot given to education can be convenient to institutions in all parts of the country, nor even different batches (morning, noon, and evening shifts) of students in the same college.

Educational technology programmes including ET Scheme of the Government of India, squarely places its investments at two ends. At one end, it suggests strengthening of infrastructures software organisations like CIET, SIET, EMRC, AVRC, Media and Educational Technology Centres of TTTIs and IITs. On the other end, the investments are on creating provision for reception sets—TV, radio, two-in-one for schools, colleges, polytechnics and engineering colleges under various schemes. The major managerial problem is to bridge the gap between broadcast and reception, and optimise on the investments.

Choice

Besides the problems of planning and management of educational technology referred above, there are a host of other issues. One issue is the choice of technology. While we are trying to have a quantum jump from low cost chart, and map technology straight on to sophisticated electronic media and computer technology, it is important to consider the role of modular technology in the form of audio-video programmes, slide tape sequences which are endowed with flexibility, and adaptability to different classroom situations. From this angle, the issue of choice of technology cannot be closed. In fact, over a period of time our choice will have to be on the modular form with mass media as the support system.

Resource is another important managerial question. Following the National Policy on Education, there has been significant growth in financial allocation in education as a sector. There have been separate allocations on educational technology under Educational Technology Scheme for school education. At the higher educational level, there has been an encouragement to procure audio-visual equipments, television sets, etc., under the development grant of UGC. In a phased programme, UGC is providing computers to the colleges. Similarly, the engineering colleges and polytechnics, under various programmes of direct central assistance and removal of obsolescence, are being equipped with modern technology and equipments including computers. Despite the shortage of resources, the important question at hand is how best the available resources can be utilised. The choice of equipments and also software are important questions.

Conclusion

Educational technology is poised for a new leap to serve some of the stated national goals of education. The capability of its service would, however, be an exclusive function of how best it is planned and harnessed. In the foregone pages, a series of issues have been raised. The first stage in planning and managing educational technology is to develop a comprehensive professional framework of educational technology. This is particularly important since by all evidence of official documents on educational technology, it is equated with media technology. It has undergone significant changes. The mass-media is seen more as an aid in the overall framework of educational technology.

Further, the misconception or partial perception of educational technology is primarily predominant among policy-makers, planners and administrators. Without having a professional view of educational technology, the decisions would not only be biased in favour of one or the other technology but its total process of implementation would be based on inadequate (and irrelevant) information. In order to safeguard against such unwanted possibilities, it is important that educational planners and administrators be given sufficient exposure to professional concepts of educational technology and the mechanisms of its implementation in schools, colleges and other institutions.

There is a tendency to denounce research in the field of education. The criticism is: their irrelevance. While this criticism is not totally baseless, one should not hesitate to add that such criticism primarily comes from those who had no occasion to look through the research that is available in the country. Particularly in case of educational technology, it is possible to cite more than 200 studies spread over various problems of educational technology which have significant planning and management implication (Mukhopadhyay 1988). One does not see the reflection of such research at all in either the formulation of the policy or deciding the strategy of its implementation. Even if all studies are not useful, it is possible to derive implications for planning and management through critical review of many such studies. In other words, in order to build up a sound basis for planning and management of educational technology, it would be important to look into research and data available on the use of media and other technologies, and their development and various kinds of experiments carried out.

Finally, in view of the new thrust and investment in educational technology primarily in media and computers at all levels of education, the implementation cannot be left to chance and differing capabilities of heads of institutions. It would be necessary to mount a programme of concurrent evaluation looking into the investment optimisation of the resource organisations as well as utilisation of educational technology provisions in the user organisations—the schools, colleges, etc.

Educational technology began its journey more than two decades ago in this country. One can derive some satisfaction for the awareness that has been generated among planners and administrators. Also, this has been introduced as a course in the preparation of teachers in many universities. The management of educational technology, in fact management of academic aspects in the institutions, has not only been elusive but has remained an unchartered area of activity in the broader context of educational planning and management. With mounting social accountability all around education, it would be difficult and suicidal for educationists and managers to ignore the demands of professional consideration of management of educational technology any more.

Works Cited

Buch, M.B., *A Survey of Research in Education*, CASE, M.S.University, Baroda, 1974.

———, *Second Survey of Research in Education*, Baroda, SERD, 1979.

———, *Third Survey of Research in Education*, New Delhi, NCERT, 1986.

Das, R.C. & Passi, B.K, *Experimental Studies on Differential Effectiveness of Microteaching Components*, NCERT, and Department of Education, Indore University, 1977.

Elton, L.R.B., "Educational Technology—Today and Tomorrow." In Hills P. and Gilbert J. (eds) *Aspects of Educational Technology XI*, Kogan Page, London

Mishra, CHK, "Educational Technology—A Trend Report". In Buch, M.B. (ed). *Third Survey of Research in Education*, New Delhi, NCERT, 1986.

Mukhopadhyay, M. and others. *Alternative Models of Teacher Training*, Bhopal, TTTI 1981

Mukhopadhyay M., "Management of Educational Technology: New Challenge in Education", *Education Quarterly*, Vol. XXXVII, Summer, 1985.

———, *Research on Educational Technology—A Review*, New Delhi, NIEPA, 1988 (Mimeo).

Mukhopadhyay M. and Sujatha K., *Planning and Management of Distance Education*, New Delhi, NIEPA, 1988.

Passi, B.K. and Shah, M.M., *Micro-Teaching Experiments in Simulated and Oral Classroom Conditions,* CASE, Baroda 1973.

Saran Y. and Chandran, G.S., *Competency Based Teacher Education in TTTI, Bhopal, Case Study,* Bhopal, TTTI, 1980.

Shah G.B. & Kulkarni, S.S., "Programmed Learning—Trend Report", in Buch M.B.(ed) *A Survey of Research in Education,* Baroda, CASE, 1977.

Shah, G.B., Mehta S. & Kulkarni, S.S., "Educational Technology—A Trend Report", in Buch, M.B.(ed), *Second Survey of Research in Education*, Baroda, 1979.

Shukla, S., "Educational Technology—Trend Report." In Buch, M.B. (ed) *Fourth Survey of Research in Education,* New Delhi, NCERT (in press).

16

EDUCATIONAL TECHNOLOGY FOR INNOVATIVE LANGUAGE INSTRUCTION

Subhash Jain

Introduction

In this presentation, I am arguing a case—a case for the right placement, right role of educational technology in our curriculum, in classroom instruction in our syllabuses, and in material production vis-a-vis language teaching and language learning, albeit it could be conveniently aplied to other areas and disciplines.

Are there better ways of teaching languages, particularly second and third languages, than those currently in use? The short answer has to be in the affirmative.

We now have available to us a wealth of data from research in learning theory, psycho-linguistics, socio-linguistics, etc. Although we still do not know precisely the processes going on during second language learning, we certainly know a lot during first language acquisition, and mechanisms and procedures during second language learning.

What we know may be summarised in a rapid review. We know that all learning pass through the same stage of acquisition; that they have a learning device which can only be indirectly affected by overt teaching; that there are different types of learners; that learning is not a mechanical or a linear affair but an organic, branching one; and that effective learning can take place in many ways different from simple transmission from teacher to student.

Language Instruction in India

Language instruction in India has been under a 'spell' : it has mainly been based on the traditional grammar-rhetoric foundations. During the last two and a half decades, in the case of English, the structural approach made some inroads into syllabuses and materials. Though not fully understood and much less practised on a mass scale, the structural approach brought in linear syllabuses, and principles of selection and gradation, repetition, pattern practice, etc. While, during the earlier part of 20th century language teaching was rule-focussed, the structural syllabuses made them form-focussed.

However, in today's world LANGUAGE is more or less synonymous with communication, and for effective communication we need:

(a) Language Competence, and
(b) Interactive Effectiveness.

The former, i.e., language competence obviously means the acquisition or learning of the four basic skills of: (i) listening, (ii) speaking, (iii) reading, (iv) writing (v) sounds and sound segments, and (vi) the underlying syntax. However, in any given context for the use of language to be effective, a certain communicative facility is needed so that what is said is: (a) intelligible, (b) comprehensive, and (c) interpretable simultaneously.

Today we also have the procedural tools needed to :

(i) analyse the learner's needs (it urges us to get away from the wrong assumption that everything needs to be taught);
(ii) design proper and adequate syllabus; and
(iii) design teaching materials reflecting the knowledge we now have about the language acquisition process and learner needs.

Further, we also have a wide variety of methodologies and teaching-learning materials to choose from. The communicative movement focusses on meaning. Language is seen as a means of communication—communicating ideas, wishes, feeling, knowledge. Learning is seen as an organic process of participation, negotiation and personal growth process—for use. Thus real language becomes essential during the teaching-learning process.

For too long we have confined language teaching-learning to the classroom alone. We assume that whatever the learner learns and acquires, happens within the domains of the classroom alone, and perhaps all that emanates from the classroom. As such, the focus happens to be the teacher, be it curriculum construction, syllabus making or teacher preparation. In the wonderful Guru tradition the teacher continues to be the kingpin of the entire game. In brief, the general assumption is: For any change, for any improvement, for any innovation, first find the teacher, train him, and 'God's in His Heaven and all's right with the world'.

One is not unfamiliar with the consequences: in the school context the teacher is the model—his pronunciation, his accent, his phraseology, even his mannerisms come to be imitated and adopted/ adapted by his pupils with varying degrees of inaccuracy and imperfection.

In teacher training institutions the focus is obviously on the teacher. Language planners and policy-makers in days of yore believed that we could overcome our inability to reach millions of pupils directly by teacher-training and that the teacher was the right agency through whom the best in language-communication—perhaps the best in any discipline—could be imparted to pupils leading to the desired modification of their behaviour.

Experience has shown that putting all our eggs in one basket—putting all our stakes on the teacher—has not been effective and that the hopes of planners and policy-makers have been belied.The continued fall in attainment levels, the poor quantum of knowledge—information—skills our pupils possess are sufficient evidence. We have been witness to the overall narrowing down of our educational goals and we seem to have compromised on the question of 'excellence'. One good look at our educational institutions is enough to convince us of the mediocrity of the system on every rung of the ladder.

Perhaps the idea of the teacher as the sole instrument of change in itself needs to undergo a definite change. The teacher is not a mechanical device: there is an inevitable variance between the inputs at training institutions and the actual output out there in schools.

The dawn of technology is not so very recent in the country that we may continue to wink at it. The radio came to be used on a large-scale roughly some forty years ago and the television a little over two decades ago. The first language laboratory in the country started functioning during the early sixties. There is hardly a village in the country where a radio or a transistor set is not found. Indeed the forces of mass media are let loose on us, almost unleashed with all their power. It is more profitable for us to use them, channelise them meaningfully so that the gap between what we want and what we get at the end of the tunnel is filled up properly.

Technological advancement obviously has an impact on teaching-learning situations all over the world affecting and effecting the processes and procedures of:

a. Curriculum development : learning experience (to be) provided to the learner;
b. Syllabus Design: Specified terminal behaviours of the learner(s);
c. Teacher Preparation : Pre- and in-service training programmes;
d. Materials Production : Both for learner and teachers.

All educational curriculum is developed in the light of the specific and overall needs of a given society, both immediate as well as long-term. Speaking for language instruction, be it first language or Hindi or English, why does society need it ? What does it want to do with the language ? How much ? To what end ? It is remarkable, however, that almost 40 years after independence, official attitudes towards English are still ambivalent. There is till uncertainty as to whether it is truly 'a good thing' or not. On the one hand it is seen as the gift of Saraswati and on the other the course of Kali. And it remains a convenient scapegoat for politicians in search of a cause.

What is not perhaps understood clearly is that different languages play different roles in a given society. English has a role; Hindi has a role; the regional language has a role. They are, or should be, complementary, and not mutually exclusive. There is a considerable amount of muddled thinking as English has been in India for over two centuries and has been the language of the ruling elite. While in certain areas no one questions the value and usefulness of English-banking, navigation, international trade, etc. in the educational system we don't seem to be sure. Once the role of English in India is properly understood in the right perspective, i.e., complementary to Hindi and the regional language, i.e. specific goals and levels of attainment need to be stated. The primary considerations are :

a. *Level :* age at which language instructions starts and the points of introduction of second language/English, etc.
b. *Duration :* period of exposure to the language and its use.
c. *Frequency :* weightage on the time-table, intensity
d. *Attainment Target:* in terms of the basic skills (LSRW), vocabulary - grammar, and communicative abilities.

In terms of language instruction, the entire exercise is perhaps to enable the learner to acquire abilities to use the language meaningfully.

In any educational programme, materials play a vital role. The framework of materials prepared certainly affects classroom methodology and the choice of techniques as well as training programmes. Unfortunately, the language work asked to be done is based on the classical stimulus-response-reinforcement theory which places emphasis on repetition, pattern practice, drills and exercises, and memorisation. Such materials are bookish; they lack vitality as they present language in pseudo-situations. No wonder that the learner attainment falls far short of its expectations. Actually what the learners need is exposure to speech events, actual interaction in order to see how communication becomes effective or efficient. As such, the materials must bring home the truth that language is malleable, that an utterance is much more than the mere sum of its individual words, and that it can be put to use in a variety of ways. Secondly, the materials must shatter the myth of 1:1 correspondence between the linguistic form of the utterance and the meaning it is intended to convey. Thirdly, the materials must make the learners see the gap between the intended meaning of an utterance and the listener's comprehension of it.

The problem of large heterogeneous classes is perhaps a universal one. The numbers have been rising steadily; disproportionate to the increase in the number of teachers. Therefore, in the changed environment of today we need to take paths not trodden before. All learning need not be confined to the four walls of the classroom. A redefinition of curriculum is called for. As effective instruments of change, instruments of learning we may consider these four modalities. Drawing an analogy from the world of playing cards we may treat them as four aces:

a. *Classroom Interaction* : The Ace of Spades
b. *Media Presentation* : The Ace of Hearts
c. *Self Instruction* : The Ace of Diamonds, and
d. *Co-curricular Activities* : The Ace of Clubs

The learning experiences (to be) provided to the pupils and the syllabus details need to be so organised that classroom work, radio presentations, television features, self-learning tasks, and co-curricular activities—all complement each other and one another, i.e., one reinforcing the other(s). A fresh look at the curriculum would, therefore, represent the totality of learning —learning springing not merely from the classroom, but including the other three aces of the radio-TV network for schools and colleges, auto-instructional materials and a variety of co-curricular activities so vital to the learner's development.

For too long educational technology and agencies other than the teacher in the classroom have played a peripheral role. A school may proudly possess a radio set but the headmaster thinks listening-in is an extra-curricular activity, a luxury that cannot be included in the normal work schedule. His assumption is : whatever the pupil does, must be assigned and the teacher must stipulate it. Whatever the pupil does outside the class is not the teacher's concern unless specifically assigned. Such a narrow view of what the pupil learns, can learn, his sources, etc., reduces him to a puppet deprived of initiative and dash and makes him solely dependent on the teacher whose shoulders are not broad enough today to accept the responsibility. In the present context, what is necessary therefore is an arbitrary but neat division of the learning tasks with inputs provided by the various agencies.

The Ace of Spades

In certain areas of language instruction, for example, silent reading or guidance during a writing session, classroom interaction is a must. The teacher needs to ensure that Johnny is reading on his own silently; while writing, immediate help is provided right there in the class. Again for certain explanations and presentations the classroom situation cannot be easily dispensed with.

The Ace of Hearts

However, in certain areas of instruction the present day teacher projects himself as a poor model. Think of crucial area: listening and speaking... Perhaps the radio is better suited to develop aural-oral skills. Concentrated listening in order to establish a man-to-man relationship, listening to stir the imagination, listening to visualise the scene, the episode, the story, listening to stir the thinking processes—that's the fare the radio provides.

With specifically tailored programmes, as in the case of nine-year-old series on the radio, Teach English Learn English in Gujarat, it has been demonstrated that the radio can successfully handle the twin jobs of teaching English and training of English. Research findings based on a massive data—300 schools covering all the districts in the State, 400 teachers, and 5,400 pupils—clearly establish that the impact of the series on listener-teacher's English is significant at .05 level and on pupils' English surprisingly at even .01 level.

The series, Teach English Learn English, a need-based and problem-oriented undertaking is co-synchronous with the progress of the syllabus-textbook in class. It chiefly handles those critical areas of language instruction which teachers find difficult. And in addition to developing listening skills, it provides practice in speech, and presents English as it is used in real-life situations. It prepares the teacher; and reinforces his training in a vital way.

These radio presentations are part of the syllabus-curriculum nexus; hence the radio has virtually become integral to the course content and the exercise a meaningful undertaking. Quite often the teacher's own language is inadequate; his hold over the second and third language phonological system and syntax is shaky and he is uncertain about the use of language beyond the macrocosm of his small world. Once the resources of the society are tapped and the radio pressed into service, as demonstrated by the series, Teach English Learn English, it is feasible to provide learning experiences to the teacher and the learner in critical areas of phonology and syntax. The radio opens up immense possibilities for the use of language in culturally rich contexts and for the desired exposure to the subtleties of communication.

The onset of television in India with its powerful visual modality opens up magic casements and in certain areas of language instruction can be more influential, more persuasive and its impact can be more lasting. Far beyond the four-walled classroom, television presentation can catapult the learner into a New Atlantis offering a challenge unexperienced before. Television presentations would highlight language in real contexts offering insights into the para-linguistic features as part of speech phenomena; they would certainly enrich the learner's understanding of who uses which language, where, when and, in a limited measure, how and why.

The plea is to use INSAT I-B Operations not merely to provide a general knowledge exposure but also provide another vista of learning experiences. Rightly used, the medium can offer materials co-extensive with the syllabus curriculum textbook and also offer the desired enrichment, thereby making television an integral part of the learning process.

The Ace of Diamonds

Each individual learns at a pace in accordance with his abilities and interests. Individualisation of instruction in the context of our large classes has become a pretty difficult task: the teacher finds it difficult to find out who has and who has not learnt, and how much and how well. As the teacher tends to the needs of the class as a whole, the individual pupil is neglected. In a situation of this kind, self-instructional strategies are vital and necessary.

Self-instructional materials in terms of multi-media packages can muster the required effort on the learner's part. To start with, the package may consist of simple materials: newspaper cuttings, pictures and features from magazines, posters, charts, pictures and photographs, shadows, graphs and tables and other collections. Where needed and where feasible, there could be slides and audio-video cassettes. These have been used successfully in some parts of the country with significantly good results.

To cite an example, we prepared twelve sets of auto-instructional materials and experimented with them in about two hundred schools in Gujarat fairly successfully. One set deals with verbs frequently used: ask, say, tell. Such self-learning activities remove whatever cobwebs there be in the learner's mind and help him gain insights into the right use of language.

Educational Technology has a vital role to play in relation to auto-instructional materials. Educational technology need not always mean elaborately set-up expensive language laboratories, many of which have been idling away for want of software. Low-cost multi-media packages with a number of self-learning tasks can extract the required effort from the learner. Auto-instructional materials therefore need to be thought of, not as homework, but a set of activities integral to the syllabus-textbooks-curriculum complexes with certain areas clearly marked for them.

With the dawn of the Computer Era in our country and with a large number of schools being equipped with computers under the CLASS project, self-instructional opportunities and possibilities have multiplied. Some of the earliest attempts at programming languages were made in the 60s by Terry Winnograd who gave his computer vision and an arm and made it work with a programme consisting of everyone hundred sememes (meaning units) on what has come to be called his 'table top' model.

In 1974 Roger Shanks considerably simplified the preparation of language programmes on the computer with his 'primitives' based on semantic componential analysis. We have come a long way in language programming on the computer since then.

Language programmes on the computer are excellent material for self-instruction and the learner can spend hours at a stretch working on them. It therefore follows that we need: (a) integration of programmes on the computer with the syllabus-textbook-curriculum complex, (b) a large number of floppies/language programme batteries at various levels suited to our needs, and (c) materials based on our socio-cultural context.

The Ace of Clubs

Materials produced so far tend to ignore the role of co-curricular activities in learning languages. It is not fully realised that a lot of learning takes place outside the classroom. The textbooks—workbooks, and supplementary readers—stand by themselves in their own world while the learner lives in another. He is interested in a variety of things—games, songs, bird-watching, fishing, mountain-climbing, stories, collecting various things, village gossip, visitors, travel, vehicles, miming, swimming, mischief and the list can go on and on. Our curricular set-up must exploit this creative energy of the growing teenager and open up possibilities whereby these activities are given due place and weightage in the scheme of things. The proposal here is to incorporate them within the curricular framework with certain portions of time clearly marked for them. Further, it is also necessary to make them co-extensive with the progress of other materials in the class, on the media, and at home.

The Teacher Training Conundrum

Any change in the approaches to the teaching of languages depends at present crucially on teachers to carry it out. Teachers in the country are accorded low status and they seem to be demoralised. A good number of them seem to be preoccupied with wage increases, material demands to the exclusion of professional concerns. The road to improvement lies in improving the professional competence of teachers, in providing some incentives to change and further, in adopting the strategy of the four aces.

The main factors in teacher preparation are :

1. *Competence* : command over language, ability to conduct classes effectively;
2. *Preparedness for the job:* education, pedagogic training, exposure to and understanding of language(s);
3. *Resourcefulness:* in handling the classroom situations, in preparing and using the materials;
4. *Attitude:* towards learners, towards language, towards his own job;
5. *Alertness* : in using the radio-television presentations, in guiding the learners to use self-instructional packages, and in initiating and guiding co-curricular activities.

Once the syllabus-curriculum stands divided into these four blocks, teacher preparation effort should focus on the teacher's own language, those areas of the instructional framework that deal with classroom interaction, and most importantly his attitude towards the subjects, towards his learners, and towards his own profession. During the initial stages the teacher needs to be involved in all other tasks outside the classroom, i.e., he needs to prepare the learners to receive the radio-TV presentations, guide the pupils to handle auto-instructional materials, solve their problems and also undertake co-curricular activities. The teacher perhaps becomes the agency to coordinate and synchronise the materials offered using different modalities and our teacher training strategies need to be re-designed to this funtion.

Conclusion

In the final analysis real change will only be affected by teachers themselves, at least in the initial stages. Mass teacher training with a lot of centralisation will not solve the problem; top-down scheme will not do. Real change ultimately must come through grass-roots networking.

While proposing an integrative and multi-skilled approach to language instructions, I am not dislodging the teacher nor belittling his role. In the present day environment in the country he holds the key to the success or otherwise of any educational undertaking or any change. He can build or break the programme. However, it is equally not right to escape from the realities of all-pervading mass media around us or from the continued educational innovations and technological advancements. It is indeed difficult to find an area, a discipline untouched by educational technology today. It would therefore not be very wise to simply fall back on past experience and continue the way we have been all these years.

The analogy of language instruction will certainly be valid for other disciplines and areas. If feasible for English instruction, why not for Geography? Bio-sciences? And others?

It is time to reframe our curricular network and to incorporate the latest in educational technology—the radio, the television, the multi-media packages, the computer programmes and a whole host of others to arrive at self-instruction and self-illumination.

17

COMMUNICATION TECHNOLOGY IN AID OF DISTANCE EDUCATION

S.P. Anand

University : Multi-Media Approach

It will be generally conceded that even in a conventional teaching-learning situation in terms of a campus-based study programme, the teaching is always multi-media based. Lectures, tutorials and seminars apart, students are exposed to practical classes, libraries, films, tapes, records and mimeographed excerpts from books. What is so special about distance teaching that communication technology may be of special value to it?

This question needs to be answered in terms of free-ranging multi-media which is either not available or not utilised by the conventional campus-based teaching. However, in the Indian context; since the choices of free-ranging multi-media are limited, the students are catered to from available materials. These are print, radio, a relatively small amount of face-to-face teaching, TV (as a future prospect), very few film shows and extremely limited community viewing of VCRs. Indeed the proportion of any given component to the total teaching package is not determined by its appropriateness but by its availability. Thus an indeterminate, media mix is offered, without reference to its efficacy or appropriateness.

Choice of Media

The choice of media depends on training, objectives, the background of the learner population, and the nature of the skills and content to be taught and disseminated. As regards the choice of media for follow-up materials, this will depend mainly on the media's ability to strengthen the educational proficiency already acquired through instructional material in print. The cases of radio and television sought to be used as media for follow-up materials bring out this point clearly.

In involving the mass media, particularly radio and television, several questions have to be asked. What is the attitude of the people to television and radio? What percentage of learners have access to these media? Is their access within their control? If it is a community listening/viewing centre providing the facility, how do the teachers and organisers react to the assembly? Can the sophisticated communicator produce programmes in the socio-cultural language of the target audience? What is the cost, and does the cost permit the use of the media?

Traditional and Modern Media

The media available for the production of follow-up materials may be classified conveniently into *two* types; traditional and modern. (A) The traditional media may be more useful in informal education at the multiple-mass level, adult education to target-groups, and continuing education in terms of primary health care, sanitation and related projects aimed at improving the quality of life. The traditional media may include folk-forms, such as folk dances, folk songs, folk theatre, puppetry and a variety of other means of communication popular in various communities. The last group would include material written on various objects traditionally employed in communities for ornamental and communication purposes. A variety of games may also be included in this category. (B) The modern media include forms of instructional materials used in formal instructional situations and may be exploited, in related genre and quantum, in a given non-formal distance education programme which may include some element of classroom teaching, either at random or in a phased and programmed manner. Some examples are:

(a) blackboard,
(b) chart,
(c) poster,
(d) flannel board,
(e) magnetic board,
(f) manually operated semi-animated objects,
(g) advertisement hoardings,
(h) wall-papers,
(i) newspapers,
(j) comic strips,
(k) radio,
(l) gramophone records,
(m) audio tapes

(n) film, slides and film strips,
(o) photographs (single variety and series)
(p) television (video and 'country-wide classroom' type)

Structuring

Exploitation of any single or multiple package of the above media is dependent on pre-evaluation which must be conducted before extending the operation on a wider scale. Preliminary arrangements must include structuring the series (selection of content, gradation of content, and sequential organisation of the package in a series of pre-test programmes, group listening activities, referral service and also the preparation of a work book/response sheet to accompany the radio broadcasts or TV transmission programme).

In general, the following factors may be considered in planning and producing all instructional packages including TV and radio series:

1. Identification of the target population.
2. The psychological characteristics and socio-economic needs of the audience.
3. The academic and/or examination-oriented needs of the target audience.
4. Content of the programme.
5. Technique of programme presentation.
6. Forms in which the programme should be presented.
7. Materials to be utilised in the series and materials to supplement the series.
8. The selection of script-writers, broadcasters and media experts.
9. Actual recording and pre-testing.

Radio and Television to the Rescue of Distance Education

(A) *Radio*

While it is good to visualise a radio-listener in the privacy of his home, the ideal is never valid on realistic grounds Radio clubs/forums have been found very useful in adult education and literacy programmes. Why can't they be useful in continuing education and distance education programmes as well? These clubs are necessary because learners' participation and collective effort are essential at every stage of the programme to make broadcasting realistic. Learners who tune in to radio to get a programme as a follow-up measure to the knowledge already acquired may be encouraged to listen in groups, at radio clubs and in self-help groups which can, over a period of time, become academic-social centres for congregation of learners. Their listening may be followed by discussion of content under the guidance of the group leader. Of course, the radio programme should have some link with reference material with the listeners so that they have something to refer to when they listen to the radio.

The effectiveness of a radio broadcast is increased when the programme writers take into account vocabulary of the target group, and if the organisers encourage learners to participate in a post-broadcast discussion session, particularly if the broadcasts themselves are so designed as to draw the listeners to a participatory programme in the form of filling in checklists and other academic exercises. There are ways in which an ingenious script-writer for radio and TV can encourage the learners into sustained academic action. One can ask the listener to write the name of an object being described or the name of a historical personage whose works are being described. One can leave space in a sentence and ask for a word to be filled in.

(B) *Television—the Present and the Future*

The television can serve to bring academic material to the student in a more direct and personal way than printed units can, and it can give a sense of association to the members of a widely scattered institution. In years to come, television (recorded video-cassettes as a support facility) can lead an entire course; but the appropriateness and cost factor of the available technology has to be kept in view. Indeed, in any distance education programme where the target audience is around 100 or so, the use of this technology would be an avoidable luxury, but where larger numbers are involved (country-wide classroom is an example) the technology can be put to proper use, within the constraints of cost and availability of resources.

(C) *Radio Television: Advantages-Disadvantages*

For effective utilisation, the radio/TV lessons should be reinforced by suitable printed reading material, supplied before and after the presentation of the programme. A TV programme, particularly for teaching a language, can be effectively designed for spelling recognition, vocabulary acquisition, speed reading, oral comprehension, and for imparting knowledge in the use of the language.

Advantages of Television

1. Communication with large audiences is possible.
2. Communication with audiences scattered in different areas is possible.
3. The vision-sound modes have a special appeal.
4. Flexibility in editing is possible.
5. Use of video-tape-recorder (VTR) makes it ideal for individualised instruction, costs permitting.
6. With accompanying/pre-despatched instructional materials, it can be very useful as a follow-up process.
7. Software production could emulate other available media such as movies/and dramas.
8. With accompanying checklists, it can be used for testing purposes.

Advantages of Radio

1. It is cost-effective.
2. It is suitable for both classroom and home-listening.
3. Even remote areas can be easily reached.
4. It is easy to use.
5. Programmes can be recorded for the future also.
6. The software design of other media can be emulated with suitable modifications.

Disadvantages of Television

1. TV is expensive.
2. Technology is not readily available.
3. It neglects a minority audience. Individualised reading is difficult to accomplish, if VTR facility is not readily available. Even when VTR is available, it is prohibitively expensive.
4. While software production is relatively easier, the software package may be expensive.
5. The time schedule is generally inflexible.
6. It is more suitable for demonstration than for immediate follow-up by the viewers. The message, unlike the printed medium, is transitory.

Disadvantages of Radio

1. Individualised instruction is not possible. Minority needs are thus ignored.

2. For the purpose of specialised teaching, radio is only an audio medium, with no visual mode.

(D) *An OU Sample Secrecy*

An interesting survey of student use of broadcasting in OU was made by the Institute of Educational Technology (IET) in 1974 and the interim results published by Tony Bates in *Teaching at a Distance* (No. 5) in March 1976. 12,800 students across all OU courses were sampled. An overall response rate of 82 per cent was obtained. Thus an average sampling error of approx. ±3 per cent on each item of information could not be bridged, but on the whole the results were phenomenally revealing. The main enquiry was how many TV programmes the students had seen over the whole year on the particular course being sampled. In other words, if there were sixteen programmes in a course, a student might reply: 'eight'. A similar question was asked with respect to radio programmes. The following ratio emerged with regard to TV programmes: (Graph converted into table)

Proportion of programme seen on each course	*Percentage of students viewing*
none	5%
quarter	12%
half	18%
three-quarters	21%
all	27%

The following ratio emerged with regard to radio listening (Graph converted into table)

none	17%
quarter	17%
half	17%
three-quarters (or near all)	18%
all	12%

Dr. Bates reached the conclusion that radio in the OU system was the poor man's aid because it could be used while eating, working or relaxing, whereas the TV required total or near-total attention and, in spite of TV's more efficacious audio-visual approach, the percentage varied considerably from 5 per cent to 27 per cent as compared to the near static figure of 18 per cent in the case of radio.

(E) *An Effective OU Approach*

One approach which the OU adopted in their Science broadcasting programmes known as *Genetics* and *Ecology* in 1976 was to set up a working group to pre-plan the academic objectives of all the broadcasts in the course. With this the broadcasts acquired an overall structure and at the same time the course structure became solid and both areas of activity progressed side by side. Another advantage of the long, overall view was that radio could be integrated to such a degree that it almost formed a single entity with television. In *Genetics*, for example, the plan was to follow each television programme with a connected radio programme which more or less started off where the television finished. To allow for this transmissions were arranged so that there was always a two or three-day gap between each television programme and linked radio programme. Each was fully supported by notes which summarised and extended the material of the broadcast so that a student was able to use many of the broadcasts as a self-contained package. This meant that he could watch the television, listen to the radio, read the notes, then turn to the main body of the text, or possibly do the whole thing the other way round. This integrated approach was very successful and OU adopted it in courses pertaining to Humanities as well.

Radio/Television Supplemented by Audio and Video Cassettes

A look at the British Open University, in the context of its broadcasting and viewing programmes for the late 1980s and the coming 1990s will be of immense use. In 1969, the availability of radio and TV channels for extensive and intensive use of the OU alone, brought about a situation in which four courses, each of 32 units could be allocated, one radio and one TV programme per week as part of each unit. BBC2 had not begun functioning. However, by 1980, with courses multiplying and smaller audience enrolled in specified courses, the transmission time, even with the additional BBC2 availability, a media-mix had to be adapted to the new situation. The planners have, therefore, found alternatives to transmission by the development of the sound cassette and the video-cassette and disc..... which are on the anvil for mass-production, as a part of the general technological change.

What found ready acceptance by course planners in OU was the signal act of release from the process of central transmission at specified times. Both audio and video cassettes brought about relevant technological change. A progressive extension of the rapidly developing use of domestic video recorders means that people can schedule their viewing to suit themselves on the same line as when they were studying from printed lessons.

The OU also continues to have access to other communication technologies. There is *Teletext,* a device whereby a limited number of 'pages' can be accessed at will by using a decoder attached to a normal TV set. Pages can be introduced from a central station very rapidly and the BBC's *Ceefax service* and ITV's *Oracle service* gives news, weather reports and other useful information. The same service started by Doordarshan gives train and flight timings and other useful data, but is not being used for the purpose of distance education. *Viewdata* introduced by the British Post Office and operating under the trade name of *Prestel* is accessed by getting a normal household telephone line attached to a modified TV set. The OU has also developed *Cyclops* using both tracks of a stereo and sound cassette, one to provide sound and the other a picture display. These technologies are still in infancy because of (a) their limited availability, (2) Viewers'/students' resistance to them, and (3) the cost factor.

Audio and Video Cassettes

As said earlier, audios and video cassettes enable a student to listen repeatedly to the material at the pace and time convenient to him.

It was in this wider context of the relative efficacy of video cassette that OU, with a Planning Board funding of £10,000, launched a project to test VCR system in study centres. Six of 27 centres in the Southern region were chosen to participate in the experiment which involved over 1,000 students: 27 per cent of students in the region, or 2.5 per cent of the total enrolment at OU. The project was aimed at testing the practicability of the use of VCRs by students at the study centre, establishing an organisation for any video cassette replay system and for testing the current level of demand by students for a system to replay television programmes. Results of the project were varied: thirteen per cent students in the region used VCRs at study centres; the vast majority of students were impressed by the new facility offered to them; no breakages or damage or loss was reported, but considerable organisational effort was needed for running the facility in the centres.

When the facility was extended to more centres, it was found that both video cassettes and audio cassettes of radio programmes were greatly in demand. The costs involved were less as compared to audio cassettes because students had replay facilities. The conclusions of the study drawn by John Marshall and Margaret Gallagher were: "The issue is a much larger one than simply whether or not to adopt a particular replay system. In future if no replay facilities are available, it is probable that the proportion of students watching television programmes and listening to radio programmes would fall steadily over the next few years."

Jim Stevenson records that the arrival of the sound cassette almost completely solved the "squeezed" radio transmission problem. In the first phase of development students used their cassettes to record radio programmes. By doing so they got more out of the material as they could replay at a more convenient time or a time and use the programmes more effectively as a learning resource. He also records that the real potential for the cassette as a medium in its own right, not related to radio transmission, was recognised before long. If students could receive cassettes in the mail rather than recording programmes that were broadcast then the students could benefit tremendously.

The planners in OU found that the possibilities were unlimited. No longer was it necessary to make a time-bound programme. A cassette can be programmed to teach any subject, for any length of time, using any combination of lesson formats, using any number of voices and, finally, making the whole package (print, radio and cassette) a complete whole.

One example is the radio course in Spanish—*Por Aqui*—where there are radio programmes, a book and two cassettes of Spanish conversation, each medium with a completely different and complementary approach.

The author has also devised a package of learning English conversation, for participants in the Diploma Courses in Youth Training for CYP Asia-Pacific Centre of the Commonwealth Secretariat at Chandigarh, involving 16 countries of the Asia-Pacific region, including India, where three cassettes, nine classroom sessions and five printed lessons are used. The results have been encouraging.

Telephone

Since 1971, the University of Wisconsin in USA has been using the Educational Telephone Network (ETN). The State of Wisconsin covers an area the size of Punjab, but the population is only 5 million. There are

200 ETN locations, some in public libraries, others in hospitals and town halls and private homes and all or any of these locations can be linked together in what is sometimes described as a 'huge party line'. At each location the ETN equipment consists of a set of microphones and a loudspeaker, and this is plugged into a standard telephone coupler. On each of the four microphones is a six-inch-long bar, so that with a class of sixteen people around the table, it was easy for any student to press one of the bars, and by doing so, to speak to all the other students in the state. ETN has been used extensively for continuing education courses including those for teachers, doctors, nurses, engineers, pharmacists, social workers, and housewives. Today ninety-five per cent of the network time is in continuing or non-credit education, with considerable emphasis on professionals.

Talking of future technologies in the service of distance education, one can take a cue from what is already happening. Reverting to continuing education courses in Wisconsin and technologies in its service, one finds funny nomenclatures such as DIAL ACCESS, SEEN, MEET-ME. *Dial Access* is a round-the-clock delivery system through which callers obtain access to a vast library of audio-cassettes. This system was first developed for continuing medical education. As many as 105,000 calls for medical tapes were handled in the very first year, some on top emergency basis where a medical emergency existed in a remote home with only single doctor attending the patient. *Dial Access* is available for courses such as 'Gardening for the Handicapped and Disabled', 'Job Readiness for Women', 'Planning Your Political Campaign' and 'Music in Early Childhood Education'. *Seen* is the State-wide Extension Education Network, a telephone line transmission system which has the added feature of an *electrowriter* and electronic blackboard, and permits the sending of line drawings, graphs and other written materials, which is a particularly useful facility in engineering, mathematics and business courses. The *Meet-Me* bridge is an automatic conferencing device. In ETN, sites are permanently linked through private telephone lines, but using the *Meet-Me* bridge, sites call up a particular number on the public telephone network and are automatically linked with other participants. This device can be used to link very small telephone audiences for highly specialised programmes while the ETN is used for larger groups.

Telephone Seminar

Like all other distance teaching media, such as radio, television, print, the telephone can disseminate teaching over a large area. The only requirements are the network facilities and an efficient call service. The telephone differs from the other media in being more highly interactive, and therefore, permitting a lesser degree of structure by the instructor than is required in teaching by correspondence text, radio, television or computer. *Structure* in this context means no more than informing participants in a telephone seminar of the topics to be dealt with in ten-minute blocks, or arranging for print materials to be distributed in advance of the seminar, or even having 'planted' questions to stimulate a question-and-answer-session. It does not use a prepared script, as any telephone conversation demands spontaneity, and the art of the instructor is to design his programme with a structure in which spontaneous interaction is possible.

A recent example would be the Doordarshan's collaboration with TV network in USA wherein Heart Specialists of India and USA interacted with each other through the telephone-TV combination to talk to one another and also address a multi-million audience in the two countries. Thus a specially valuable characteristic of the educational telephone is the potential to meet highly specialied needs, and in this it can be contrasted with broadcasting. The 'mass media' may be used for communicating with large audiences, but is inefficient with a clientele of only a few dozen specialists. The two media can, of course, combine to have the benefit of both situations.

Finally, because the medium of telephone is interactive and relatively unstructured, there is an element of 'immediacy' about it which is missing in a programmed broadcast. The telephone seminar seems to permit the expert to risk up-to-date and up-to-minute reports, to guess, to hypothesise, to offer and to stimulate new ideas, and in general to communicate in a less formal manner then can be possible in print or the broadcast media.

Works Cited

Anand, S.P., *University Without Walls:* Vikas, Delhi, 1979.

———, A Distance Education Course for Trans-national Dissemination, read at World Conference of I.C.C.E, Vancouver (Canada), June 1982.

Bates, A.W., *Student Use of Open University Broadcasting,* The Open University, Milton Keynes, U.K., 1979.

———, 'Survey of Student Use of Broadcasting', *Teaching at a Distance*, No. 5 1976.

Flinck, R.(1975), *The Telephone as an Instructional Aid in Distance Education*, University of Lund, Sweden, 1975.

Gallagher, M. and Marshall, J., "Broadcasting and the Need for Replay Facilities at the Open University", *British Journal of Educational Technology*, Vol. 6, No. 3, 1975.

Literacy Curriculum and Materials Development: Monograph No.4, on Follow-up Materials Development: UNESCO Regional Office for Education in Asia and the Pacific, Bangkok, Thailand, 1981.

Marshall, & Gallagher, "A Cassette-Replay System for Students", *Teaching at a Distance*, No. 3, May 1975.

Moore, M.G., 'A Model of Independent Study', *Epistolodiactica*, 1977..

Moore, J.M., "Telecommunication in F.L. Instruction", *Audiovisual Instruction*, No. 10, 1965.

———, 'Educational Telephone Networks', *Teaching at a Distance*, No. 19, pp. 24-31.

Rao, P.V. and Hicks, B.L. "Telephone-based Instructional Systems". *Audiovisual Instruction*, April, 1972.

Rowland, 'Some Thoughts on the Use of Broadcasting in the Open University' *Teaching at a Distance*, No.2, Feb. 1975.

Stevenson, 'Science Broadcasting: A Look Towards a 1976-Course', *Teaching at a Distance*, No. 3, May 1975.

———, "Media in the Open University: A look towards the 1980s", *Teaching at a Distance*: No. 19, 1981.

Telephone in Education Newsletter, University of Wisconsin Instructional Communications Systems, Spring, 1977.

Wedemeyer, C. and Najem, R., *A.I.M. from Concept to Reality*, Syracuse University Press, 1969.

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